

## **Energy, Cleantech, and Intellectual Property: Managing Technology Convergence and Protecting Innovation**

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While intellectual property (IP) is always an important component to the success of any technology-based company, it is arguably especially important for “cleantech” ventures directed to energy and/or environmentally-related technologies. Cleantech is a broad field with several narrow subsectors - the technologies embraced run the gamut from older technologies that have been around for several years, in some instances already in the public domain and now being recycled, to cutting-edge research coming out of academic and industry labs. Some of the innovations involve fundamental technology breakthroughs that may warrant broad protection. In other cases, however, an incremental and seemingly narrow improvement in an already crowded area of development may provide an important enabling solution having significant commercial value.

In any of these scenarios, IP has important roles to play. With the relatively recent re-emergence and explosion of cleantech, and with so much still in flux, we believe that no proven thesis has yet evolved for “Cleantech Best IP Practices.” Moreover, the diversity of the technologies, IP landscape and market conditions involved is not conducive to a one-size-fits-all approach. However, there are some significant issues that are characteristic of many cleantech efforts and that generally set this space apart from other technology sectors. By exploring these cleantech-specific issues and asking how they may impact IP strategy, we can gain valuable insight toward building a comprehensive and multi-faceted model for addressing cleantech IP.

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## Defining Cleantech

Undoubtedly, cleantech means different things to different people. We consider an inclusive definition that goes beyond renewable/alternative energy sources, to include retrofit and new energy technologies related to fossil fuels, as well as environmental technologies related to reducing carbon footprint, pollution abatement, water treatment/resource management, and others. Renewable/alternative energy sources are promising and necessary for the complete long-term future energy picture, but these sources alone are expected to be insufficient to deal, at least in the short term, with the imminent energy challenges at hand. Perhaps the biggest part of the energy picture that needs to be addressed now is improving the fossil fuel supply chain while mitigating the harmful environmental impacts of the significant hydrocarbon usage unavoidably required to meet the booming energy demand worldwide. Additionally, for both the near and long term, any energy solution that is sensitive to impacts on water and food supplies undoubtedly will be of increasing importance.

In view of the foregoing, we view cleantech as embracing a wide scope of technologies that address the increased global demand for energy, provide for a reduction in the negative environmental footprint of various human activities, and/or facilitate a greater independence from fossil fuels. These include products and services which promote, enhance or advance the diversity of energy supply sources, as well as improvements in energy transmission and efficiency in use. Examples of such technologies include, but are not limited to:

- Renewable/alternative energy sources such as solar (PV and thermal), wind, geothermal, hydro, bio-fuels, fuel cells, nuclear;
- More effective use of fossil fuels: cleaner use of coal, CO<sub>2</sub> sequestration/abatement;
- Energy demand response: grid management, delivery and transportation, resource mining, extraction and refining (e.g., improved oil recovery methods);
- Conservation and efficiency: hybrid/electric/fuel cell vehicles, improved lighting, environmental control systems, appliances, consumer products, building use;
- Waste management, recycling technologies and water-related technologies (purification, desalination, conservation);
- Sustainable architecture/design, advanced building materials;

- Facilitating technologies: power electronics, storage systems and batteries, cables and wires, sensors and instrumentation, materials and manufacturing technology.

## **Cleantech Attributes**

There are certain key attributes that appear to be common themes for many cleantech ventures and that can have a substantial impact on IP strategy and management. Any one or more of these attributes may not apply specifically to a particular cleantech venture, but on balance they appear to generally delineate unique aspects of the sector as a whole as compared to other technology sectors.

First, cleantech innovations typically require interdisciplinary integration of scientific knowledge and engineering principles. Those in the cleantech sector need to understand the core scientific drivers of the market as well as the technology or science drivers behind the innovative solutions being provided. This could well mean having to possess an appreciable and simultaneous understanding of chemistry, materials science, mechanical and electrical engineering, biology and biotech, environmental sciences, and/or information technology and computer science.

Second, cleantech endeavors often require a longer time frame to get “traction” or “bear fruit,” from demonstrating initial proofs of principle to ultimately “getting to market.” While the current enthusiasm for cleantech companies may be compressing the time frame somewhat, the historical average of innovation traction in the traditional fossil-fuel based energy space, for example, is in some instances significantly greater than 10 years. If this trend is at all instructive, it strongly suggests that today’s cleantech ventures often will require persistence and patience, and business strategies that contemplate appreciably long time frames.

Third, there may be limited routes to market and/or various factors that may impact adoption in the marketplace. Particularly in energy matters, it is often the case that there is an existing hierarchy which controls some infrastructure (e.g., utility companies that constitute virtual monopolies, or government agencies at various levels). Other considerations include the durability of the existing infrastructure, the tremendous cost and time required to significantly change it, and the reluctance of at least some constituency of consumers to adjust behavior when it comes to energy consumption. Disruptive solutions, however innovative they might be, may

not always be plausible in the market place, at least in the short term. Those in cleantech need to be mindful of possible limitations to market entry/adoption, and need to consider creative ways of working within the constraints posed by existing infrastructure and with the controllers of the infrastructure, by, for example, positioning their innovation with sensitivity as to how it interfaces with or “plugs in to” the existing framework.

As additional considerations, cleantech is often capital intensive and involves a bigger financial scope and scale than many other tech sectors. Moreover, government actions such as regulations or incentives, as well as public perception, can significantly affect opportunities for cleantech innovation around the world. This may not be entirely unique to the cleantech sector (the medical and biotech areas have similar considerations); nevertheless, public policy, here and abroad, is an important (and potentially volatile) driving factor for cleantech.

## **IP Tools for Cleantech**

Of course, the IP tools generally available for protecting any innovation apply to cleantech as well. However, the various cleantech attributes outlined above can appreciably shape IP considerations for a given cleantech venture. First, we provide a brief introduction to some essential IP tools and comment on their applicability to cleantech, followed by a more detailed look at how some of cleantech’s generally defining attributes may impact IP strategy.

**Patent protection** is perhaps the most common IP tool employed for many technology ventures, and a number of factors may affect the procurement, effectiveness and usefulness of patent protection in the cleantech space. Of significant importance for many cleantech innovations is the convergence of multiple technologies, as noted above, and how a patenting approach may be specifically crafted to protect novel and valuable aspects of such convergence. Another important consideration is the particular role of patents in a given cleantech business strategy – are patent filings useful to the business primarily to establish credibility and instill investor confidence? Are there patents that bar market entry in one or more jurisdictions? Is marketplace exclusivity and a strong defensive position more or less important? How important to the business is IP for providing leverage for licensing and partnering opportunities, or increasing acquisition valuation? The answers to each of these questions can significantly inform the patent protection strategy adopted for a given cleantech innovation.

**Agreements** that are crafted with particular sensitivity to IP issues provide another valuable IP tool. For many cleantech endeavors, from the lab bench to full commercialization, there is an expanded role for technology partnerships, consultants, and advisors in a variety of fields, and perhaps licensing-in of important technology pieces. As a result, there is generally a greater opportunity for the significant flow of important information, and an especially high level of attentiveness to the protection of proprietary information and IP ownership issues through carefully crafted agreements is warranted. In this same vein, **trade secrets** can provide alternative or supplemental protection for some innovative solutions, for example, those involving improvements to and/or combinations of existing technologies according to particular methodologies or “recipes” that would be difficult to reverse engineer. Careful consideration of possible trade secret protection, together with a heightened sensitivity to possibly limiting information transfer, can be especially important in dealing with commercialization partners across jurisdictional boundaries.

**Trademarks** also have an important role to play in the cleantech IP landscape, particularly given the noteworthy role of public perception in this space. Energy policy tends to be an emotionally charged issue, and the impact of branding on public perception can significantly affect technology adoption, competitiveness and, ultimately, commercial viability and market value.

## **IP Strategies for Cleantech**

With some observations on generally-defining cleantech attributes and available IP tools in mind, we now turn to some important considerations for developing a valuable IP strategy for a given cleantech venture. For cleantech innovators and entrepreneurs, it is important to keep in mind that investors generally expect IP protection even if the overall business strategy focuses on execution more than development. Investors appreciate that strong IP is important both for first to market companies (to exclude entry of competitors) as well as those that follow (to protect a key value-added proposition for later market entry or licensing/acquisition leverage).

Regarding procurement of protection, those involved in developing a cleantech IP strategy need to appreciate the importance of understanding all of the technology dimensions involved. Again, many cleantech innovations involve a convergence of multiple and sometimes

significantly diverse technology pieces, and this technology convergence creates potential IP pitfalls, but also a potential for enhanced IP protection. For example, appreciable protection may be available not only for the resulting combination of technologies that leads to a particular innovative solution, but additionally one or more of the respective technology pieces, and/or how the respective technology pieces fit together (“internal interface points”), may be separately protectable. On the other hand, not having a full appreciation of all of the technology pieces may leave important synergies unprotected. We have already noted above that technology convergence may provide greater opportunities for information exchange during development and commercialization efforts; accordingly, apart from IP procurement, technology convergence also warrants an increased sensitivity to IP issues (ownership and protection of proprietary information) in agreements.

In academic and corporate research settings, the technology convergence contributing to many cleantech solutions may provide rich possibilities for invention mining and creative bundling for commercial exploitation. Different areas of research that historically may have had no apparent connection to each other, or to energy and the environment, may suddenly find themselves significantly relevant in combination (e.g., consider the synergy between respective research efforts in diverse areas such as microbe biology and high-efficiency low-power electronics for fuel cell applications). Accordingly, technology licensing officers at universities, managers at research facilities, portfolio managers at holding companies, cleantech entrepreneurs, and investors should consider thinking beyond conventional boundaries dictated by researcher/principal investigator, particular school/department, or particular research project or group in an effort to exploit combinations of technologies for licensing and commercial implementation opportunities.

Those involved in developing an IP strategy for a cleantech innovation also need to keep in mind the market entry “interface” point(s) (e.g., where/how the innovation will be adopted, or “plug in” to an existing infrastructure). Such interface points may constitute bottlenecks with which a variety of technologically diverse innovations need to contend. Accordingly, IP directed to integration with an existing production/delivery/distribution infrastructure (IP on “the plug”) may in some cases transcend protection of the core technologies associated with a given cleantech innovation and be of key importance.

Additionally, legacy technology does not mean unprotectable technology. Although some current cleantech efforts build upon work that began years and perhaps even decades ago (and may be long in the public domain), inevitably today's solutions will involve at least an incremental if not significant change or improvement to some aspect of the legacy technology. Some innovators may not fully appreciate, and overestimate, the magnitude of "newness" or technical sophistication deserving of IP protection. It is generally safer to err on the side of taking a careful look at the possible protection available for a seemingly trivial innovation, rather than presuming it is too insignificant to warrant protection.

In this spirit, it is important to note that incremental or narrow innovations nonetheless can be commercially very valuable in the cleantech space, and IP protection should not be ruled out if a broad scope of protection appears to be unavailable. When it comes to energy-related challenges, innovators often need to simultaneously consider supply/demand issues, environmental impact, and national security interests, and provide solutions that positively impact price, reliability and scalability. Even in crowded areas of development, incremental innovations, however seemingly trivial, that achieve any one or more of these things and provide a lynch-pin type of enabling solution are likely to be extremely valuable.

For cleantech ventures with a long time frame to market and/or a long technology lifespan, patent protection should not be discounted or dismissed with the view that protection might have a limited remaining life or be virtually expired by the time the innovation reaches commercial maturity and/or bears fruit for the long haul. Strategic patent application filing approaches can be employed in many key jurisdictions to increase patent enforcement life. For example, a patent application filing on a particular innovation might be delayed until the effort reaches a certain state of "maturity" or potential commercial viability. Since the enforcement term of a utility patent typically is dictated by the filing date, later filing dates generally result in later expiration dates. Of course, any delay in filing needs to be carefully weighed against possible disclosure events (intentional or inadvertent) and how these may impact/jeopardize rights in various jurisdictions. Another possibility for extending the overall life of a cleantech patent portfolio is to file one or more initial applications relating to core aspects of the technology, and then stagger over time subsequent patent filings to incremental improvements/changes. Additionally, in some instances a "slow" examination unit at the U.S.

Patent and Trademark Office (USPTO) may be targeted by particularly defining the subject matter for which protection is sought. Under certain circumstances in which delays in examination are attributed primarily to the USPTO, a slower examination may contribute to a “patent term extension” once a patent is granted.

Given the global applicability of cleantech innovation, strategic international IP protection may be of significant importance. Building a comprehensive international IP portfolio can be expensive and time consuming (i.e., significant time to patent grant) in any technology sector. Protecting innovation globally typically takes into consideration those jurisdictions in which significant market opportunities are present or anticipated, as well as jurisdictions in which potential competitive activity (e.g., manufacturing) may be likely. For cleantech, this exercise should include an additional sensitivity to the dynamics of international policies (e.g., regulations, incentives) and jurisdiction-specific enforcement issues relating to energy and the environment, which in some instances may be significantly volatile and difficult to forecast.

As also noted above, another important consideration for a cleantech IP strategy includes branding and the role of trademarks. In the U.S. and abroad, energy is inextricably tied to controversial natural resources, public safety, and environmental issues, and with this come public politics and occasionally intense emotion. The impact of branding on public perception can therefore significantly affect market value. At the same time, cleantech endeavors may face particular challenges given the limited vernacular that is both available (i.e. not already registered/used) and capitalizes on existing public association (“green,” “clean,” “eco,” “earth,” “friendly,” “organic,” “enviro,” etc.), not to mention the dense rush of trademark applicants who are seeking similar protection, resulting in a sort of “green gridlock” at the US Patent and Trademark office. For this reason, although somewhat counterintuitive, it may be more beneficial in the long run to consider alternatives to the perhaps more obvious green-branding choices, while at the same time being mindful of the heightened sensitivity of public perception to energy and environmental issues.

## **Conclusion**

While there is no one-size-fits-all approach when it comes to cleantech IP, there are nonetheless some general attributes of many cleantech efforts that should be considered when

assessing possible IP strategies. We have identified what we believe to be the most salient of these attributes and explored how they should inform an approach to IP protection.

To summarize some of our key recommendations:

- Appreciate the importance of understanding all technology dimensions involved; technology convergence creates potential for enhanced IP protection.
- In academic and corporate research settings, technology convergence contributing to many cleantech solutions may provide rich possibilities for invention mining and creative bundling for commercial exploitation.
- IP directed to integration with existing production/delivery/distribution infrastructure (IP on “the plug”) can in some cases transcend core technologies and be of key importance.
- Legacy technology does not mean unprotectable technology.
- Incremental/narrow innovations can be commercially very valuable; don’t rule out protection if broad scope appears to be unavailable.
- For cleantech ventures with long time to market and long technology lifespan, increase patent enforcement life via strategic filing approaches.
- International IP protection considerations for cleantech should include sensitivity to the dynamics of international policies (e.g., regulations, incentives) and jurisdiction-specific enforcement issues.
- Consider elevated importance of public perception on branding, but beware of “green gridlock” when considering trademark protection.

While some of the identified cleantech attributes may have a greater significance than others for a given venture, being mindful of the variety of issues germane to many energy and/or environmentally-related ventures will invariably be helpful toward building a sensible model for protecting cleantech innovations.



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Joe Teja has significant experience in counseling clients with substantial and complex portfolios in connection with IP protection strategies. He represents clients in a variety of technical areas, including energy-efficient lighting technologies, efficient power generation from organic fuel cells, high speed optical memory, precision nanoscale light sources, and semiconductor device fabrication. He also has significant experience working with academic institutions to protect their IP assets.

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Mike Pomianek focuses his practice on patent prosecution, opinion work, due diligence, and IP counseling. He works with clients in the areas of chemical processes, chemistry, alternative energy and other cleantech technologies, carbon dioxide mitigation and other environmental technologies, biomedical engineering, medical devices, analytical devices, food products, textiles, and nanotechnology.

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## **WOLF GREENFIELD CLEANTECH GROUP**

### **Strength Across Multiple Disciplines**

A strong intellectual property position is a critical component to the success of any cleantech venture. But establishing and protecting that position is complicated by the diversity of the science involved in cleantech advances. By their nature, innovations designed to change our global reliance on traditional energy sources and reduce the environmental footprint regularly blur the boundaries of scientific disciplines.

Our clients recognize that we have the strength and breadth of legal and scientific expertise across the various technical disciplines that are integral to the cleantech industry. They appreciate the fact that we can easily customize a team of attorneys and technology specialists who are able to quickly grasp any unique convergence our client is leveraging in the market.

This group, all of whose 21 members have advanced degrees, offers expertise in such areas as: biotechnology, inorganic and organic chemistry, chemical engineering, materials science, electrical engineering, optics, and mechanical engineering.

### **Broad Client Base**

Our cleantech clients include a wind turbine manufacturer, a manufacturer of recycling equipment and recycling facilities, a company engineering bacteria and yeast for producing ethanol, and a manufacturer of energy efficient lighting. In addition to emerging and established cleantech companies, we work with academic and research institutions as well as venture capitalists and other investors who are looking to identify, explore, and invest in next-generation clean technologies.

We provide the full range of IP services to our clients including: IP portfolio development, patent and trademark prosecution, due diligence, opinions, licensing, and infringement enforcement and defense.

### **Industry Involvement**

Our Cleantech Group participates in and sponsors industry groups and events such as the Ignite Clean Energy (ICE) Business Competition, New England Clean Energy Council, Renewable Energy Business Network, and Mass Tech Transfer Center Clean Energy Conference. Members have also served as judges and mentors for the MIT Clean Energy Entrepreneurship Prize. Our clients appreciate that we are active in the industry, staying current with emerging trends, ideas, and competition in this rapidly evolving space.