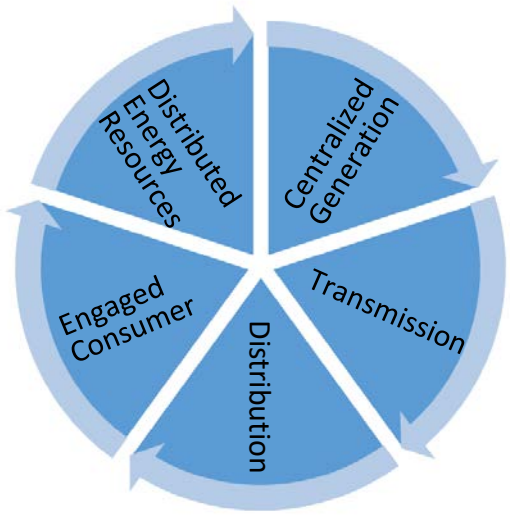
IP Trends in the Energy Value Chain

October 2016

The energy landscape is transforming at a dizzying pace. The introduction of lower cost materials (prices are dropping on batteries and PV panels) and new financing models (new Power Purchase Agreements, unregulated markets and others), along with government involvement, have spurred the growth and re-organization of the energy value chain.

What was once a linear value chain, mostly controlled by large utilities from generation to consumer, is now heading towards a circular system. The introduction of technology like smart meters has created an infrastructure that allows the consumer to now be an aggregator or even a generator of energy, creating opportunities for some and posing threats to others (utilities).



The Circular Energy Value Chain

As the activities in the energy value chain are redefined, where will the opportunities emerge? In the "old" value chain, access to the market was limited by technology, regulation, and cost. Now, with costs falling and access to technology easier than ever, companies are looking to patents to protect their market positions.

Patents, however, play different roles at different points in the value chain. This paper provides an overview of the value chain and the role of IP. Subsequent papers will address, in detail, strategic approaches that utilize IP to remain technologically relevant and financially sound.

Centralized Generation

Centralized energy generation was the foundation of the energy system for more than 100 years. It was fueled by non-renewable resources and mostly owned by large utilities. The past 30 years, however, have seen a dramatic shift in energy production technology and ownership.

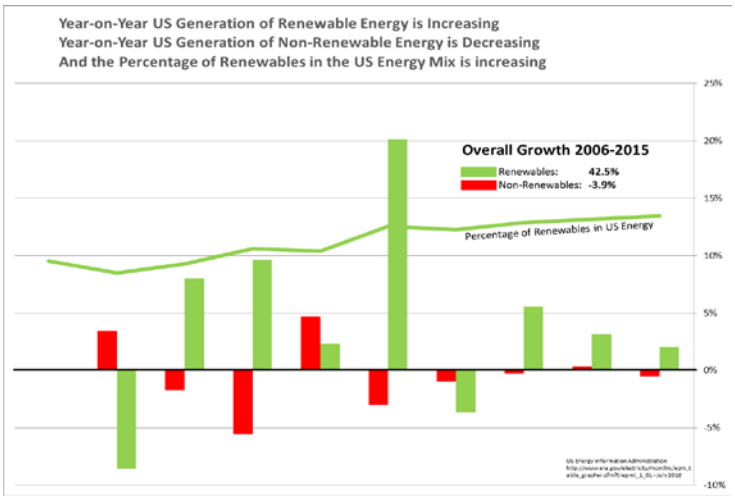
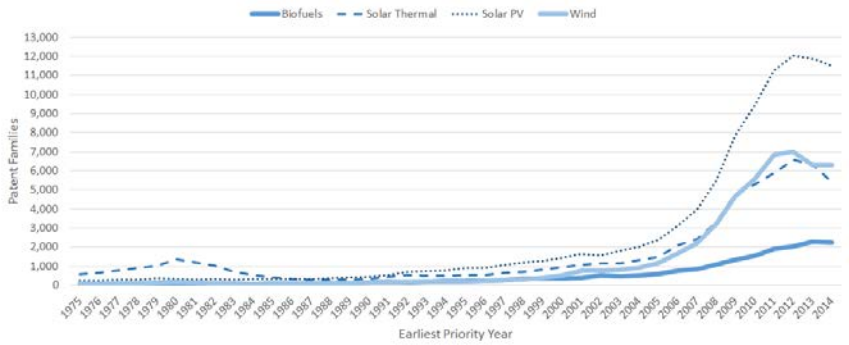


Figure 1 - Growth of Renewable Energy Generation in the US

The past ten years in particular have seen a significant shift in focus from non-renewable to renewable generation. According to the U.S. Energy Information Administration, net generation from renewable energy has grown by 42.5% and now represents more than 13% of the U.S. energy mix. At the same time, traditional non-renewable energy has declined by nearly 4%. This trend is even more pronounced globally, as the *International Energy Agency* has estimated that renewables represent 23% of the global energy mix. (Tracking Clean Energy Progress, 2016)

IP Trends

This trend is also reflected in the patent filing record. Companies are using patents as one of the tools to define their share of this rapidly growing market. Patent application volume increased dramatically during the 1990s and 2000s for technologies that cover renewable energy generation (primarily wind, solar thermal, solar PV, and biofuels).



Although the patent activity is still relatively high for the space, there is a marked downturn in the the rate of application despite continued growth in overall filings. From 2011 through 2014 (the latest reliable data), patent activity in the generation space dropped by around 8%. Much of the drop is accounted for by solar technology (approx. 15%) in response to the maturity of the space and subsequent decline in breakthrough technology. Although biofuel technology filings are still rising, the volume of applications is less than half of those for solar and wind.

Transmission

Transmission is the backbone of the electrical system. In the U.S., regional transmission planning organizations manage energy flows and infrastructure. Changes to the federal regulation of this space in the U.S. has dramatically impacted how these organizations work together, share costs, and work to effectively integrate the (intermittent) energy created by renewable resources. Due to the scale of the infrastructure, there are relatively few companies operating in this space.

Despite the limited number of players in the space, the demands of the market are driving innovation in transmission technology. Utility scale renewable generation requires improved efficiency and quality over greater distances to service remote generation facilities. Further, the intermittent nature of renewable energy requires advancements in control and load balancing systems.

IP Trends

At first glance it appears that innovation in the transmission space has exploded in the past five years. With triple the number of patent applications in 2014 versus 2010, technology that addresses the demands of the evolving transmission system appears to be emerging. Closer inspection, however, reveals that this acceleration of patent applications is focused in China and increasingly issued to educational and governmental entities.

The increase in Chinese patent activity is an interesting phenomenon for a country with a challenged relationship with IP. Adam Bulakowski of ipCG discussed ramifications of China's evolving patent system on IPSTRATEGY.com in October, 2015 (https://ipstrategy.com/2015/10/26/china-and-the-next-great-wall/; http://www.ipcg.com/?file=China_and_the_next_Great_Wall). Regardless of the quality of any concern over the Chinese patent system, companies operating in this space need to pay attention. Even if less than 20% of the Chinese patents are transferable to foreign markets, China will own the technology space.

The other notable trend is the decreasing patent activity in Japan and the increasing diversity of patent jurisdictions, particularly Asian. The decreasing rate of patenting in Japan is indicative of the maturity of the Japanese transmission industry. Similarly, the entry and increasing activity in Korea are reflective of their growing industrial sector.

Takeaway

The dramatic rise in patents in Asia may or may not be an indicator of innovation, but it is clearly an expression of interest in the technology. These patents may provide a barrier to entry into these markets from western firms and also threaten operations in home jurisdictions when the Asian patent holders begin to seek protection in western markets. An IP strategy that incorporates the impact of the Asian patent activity will be critical for global scale success.

Distribution

As the transmission system is characterized by large regional entities supported by a limited number of technology suppliers, the distribution system is comprised of primarily (relatively) small organizations that deliver the power from the transmission grid to the end user via a wide variety of technologies. Whereas the transmission grid carries wholesale power, the distribution lines carry retail power directly to customers. The distribution system is what most people recognize as the “power company.”

Innovations like smart-meters and affordable consumer grade distributed energy resources (DER) like solar and battery storage have radically changed the business model for the power companies that operate energy distribution systems. Companies that once operated as monopolies (and largely still do) now find themselves needing to partner with private sector companies and upstream transmission companies to access the necessary technology and resources.

IP Trends

The increase in patent activity in the distribution system is more prolonged and more dramatic than that of the transmission system. This reflects a much larger and more dynamic market with many more buyers and market demands. Where the transmission system is large and regional, the distribution system is local and managed by many independent operators. This creates a market where innovation can be more readily adopted and implemented.

Takeaway

Changes in the energy system are dramatic at the distribution level. Utility companies are trying to remain relevant and re-define their value proposition and technology companies are finding new ways to enter the market. This is reflected in the dramatic increase in volume and rate of IP filings over the past six years. Even if this filing trend flattens as the industry matures, IP will continue to define the technology that will allow companies and utilities to successfully transition their businesses to function on the modern distribution grid.

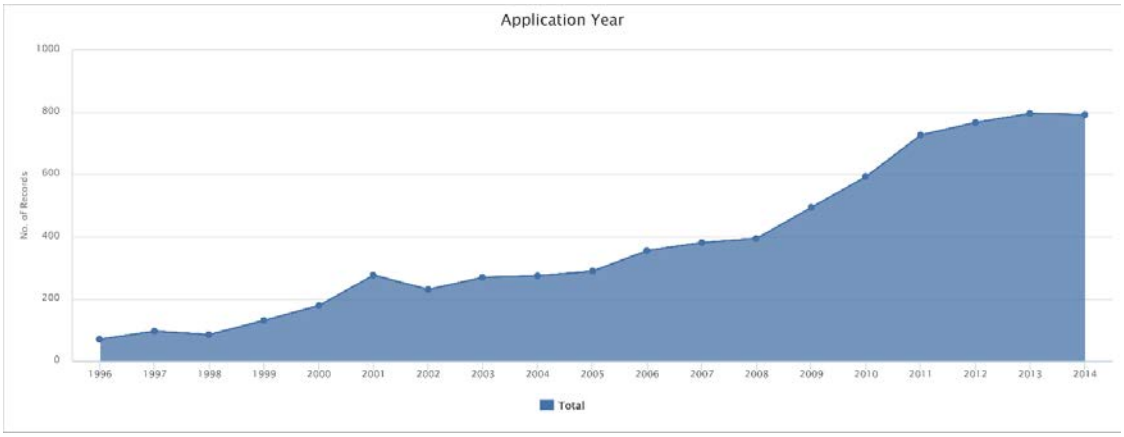
Engaged Consumer

Consumers of electricity today have more options than ever available to reduce the cost of energy. Through efficiency measures, consumers can lower their potential demand. Through demand response, consumers can shift their demand to different times of day, taking advantage of time of use pricing from the utility. Consumers can even partner with the utility to allow for dynamic control of appliances by the utility to optimize loads and reduce cost. This can be a win-win situation: consumers benefit from lower energy costs, while utilities benefit from more predictable and controllable demand profiles. This allows utilities to better budget for and even avoid spikes in demand that lead to the purchase of more expensive “peaking” load energy.

The rapid growth of information technology and the internet of things (IoT) has allowed for consumers to be more engaged than ever. Consumers now have the power to monitor efficiency and demand from their smartphone and directly visualize the impact of dynamic control on their monthly energy cost.

IP Trends

Technology that supports the engaged consumer grew steadily from 1996-2008, most likely in anticipation of the smart-meter revolution. With the decline in solar prices and a critical mass of smart-meter penetration, IP for technology that enabled consumer energy management exploded. By 2011, IP activity flattened out. This not only indicates a maturing market but could also be a reflection of the increasing scrutiny of software patents after *Alice v. CLS Bank*.



Takeaway

The hardware that allows the consumer to connect and engage with the utility has been developed. IP covering these technologies will soon expire and create new opportunities. Existing patent holders will need to find new and novel inventions around their core technology and new players will be freer to experiment on these platforms. Software will continue to be an integral part of consumer engagement. IP will be needed to protect market position, but care and attention will be needed to ensure that the software is patentable under the scrutiny of *Alice*.

Distributed Energy Resources

Distributed energy resources is a broad category of technology that includes and overlaps with all of the other points on the value chain. Often DERs are referred to as “behind-the-meter” and include things such as batteries and other storage devices. For the purposes of this paper, however, we have broadened the concept to include any technology that supports the decrease in demand for centralized power generation. This includes both decentralized generation and storage technologies and the control systems that integrate them with the grid.

DERs are a critical component of the evolving smart grid system. The technology that supports the roll out of DERs allows for greater energy control, improved grid stability, power quality management, and other financial benefits for both the utilities and consumers.

IP Trends

Again, patent activity in China severely skews the patent acuity trend. In this case, however, there are also significant trends in other jurisdictions. First, even without China, patent activity in this space is increasing. And maybe even more notably, applications through the WIPO office have made a noticeable impact. These two trends combined point to the global interest (and markets) for DERs.

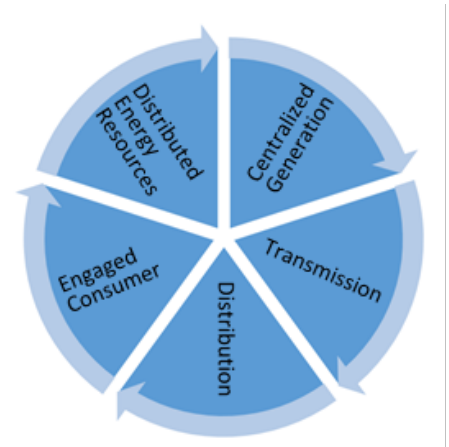
Similarly, generally increasing activity in the U.S. market speaks to the emerging market for DERs and solar power in particular. As the cost of these resources declines and becomes commoditized, innovation will be needed to maintain market presence.

Takeaway

As can be seen in *Generation,* IP filings drop as a product or industry becomes commoditized. Although DER is still rising globally, China is playing an outsized role. Looking only at the non-China filings, the trend appears very near that of generation: commoditization and the associated price impact is looming. To get ahead of the impending commoditization of DER technologies, innovation and IP strategy will be needed.

Conclusion

The dramatic growth of the energy industry over the past 15 years is reflected in both global revenues and patent filings. New technologies have driven this growth and served to reorganize the energy industry. We are quickly headed towards a "circular" energy value chain that is creating new opportunities and challenges.



The Circular Energy Value Chain

Identifying the opportunities and creating new innovations will be the key to addressing the evolving market. Without the protection of "regulated monopolies," IP will be a key component of new business models throughout the energy value chain that allow companies to carve out a protected space.

Although IP filings to support *Distribution* and the *Engaged Consumer* are stable or rising, the decline in filing activity in *Generation* and *DER* could be a signal to the industry that

commoditization is creeping in. An intentional approach to innovation and a well-thought-out IP strategy will be necessary over the next decade to ensure business success and protect market position.

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About ipCapital Group

ipCapital Group (ipCG) is an innovation and intellectual property (IP) consulting firm serving clients that range from early stage to Fortune 500 in over 800 engagements since 1998. For more information, visit www.ipcg.com, or contact us at jpadgett@ipcg.com.