



Patent Landscape on Green Technology in Vietnam

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Patenting in green technology for both domestic and foreign applicants has entered a boom period in Vietnam. The government is geared towards promoting sustainable green development in the country. In this article, we provide some of the highlights concerning the status of green technology development in Vietnam. We will explore the landscape of green patenting in the country, particularly in recent years. We also present trends of patent filing (for domestic and foreign applicants) for specific fields of green technology in Vietnam which serve to highlight the growing alternative energy sector.

Green industry refers to a growing operational strategy applied to minimize environmental impact while realizing sustainable development. It can be applied to any sector where there is a desire to achieve significant improvement while eliminating environmental pollution and excessive usage of resources.¹ Approximately 90% of green technologies are developed in the United States, Germany, Japan, France, Korea, and other OECD countries. India and China have also made significant progress regarding the development of green technologies illuminating the importance of adopting alternative energy in the contemporary world.² Austria and Brazil are also two countries that are performing very well in relation to patenting green technologies.³

Green technology offers a promising economic strategy for Vietnam, a nation that has been adversely affected by climate change and pollution. The country's natural resources have gradually been depleted over the years due to environmental issues.⁴ Statistics drawn from the OECD and the World Bank indicate that many people in Vietnam had been exposed to worrying pollution levels which are above the 2017 guidelines stipulated by WHO. In the country, almost 100% of the population is exposed to pollution and exposure to PM2.5 is 30.3 micrograms per cubic meter.^{5,6} In addition, Vietnam is ranked 27th in regards to greenhouse gas emission with its emission accounting for 0.72% of the total global emission.⁷ By April 2018, Vietnam had 245 proposed renewable energy projects. Nonetheless, only 19% of the projects progressed to the constructions stage and only 8% operational at the time of this article's publication.⁸ Out of the different forms of renewable energy utilized in Vietnam, hydropower holds the lion's share, followed by biomass and wind. Solar energy, biogas, and waste-to-energy technologies are gaining a strong footing in Vietnam whereas tidal and geothermal energy are very much still in their infancy.⁹

The government adopted an ambitious program 'Vietnam National Green Growth Strategy (VNGGS)' in 2012. The primary objective of the initiative was to lower the nation's Greenhouse gas emissions (GHG), national

¹The United Nations (2012), *Towards green growth through green industry development in Viet Nam*. Available at: https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Towards_GG_Through_Green_Industry_Development_in_Viet_Nam_U_NIDO.pdf

² OECD (2017), *Green Growth Indicators 2017*, OECD Green Growth Studies, OECD Publishing, Paris, Available at: <https://doi.org/10.1787/9789264268586-en>.

³ Zacco (2017), *Green Tech and IP strategies*. Available at: <https://www.zacco.com/insights/green-tech-and-ip-strategies/>

⁴ *Three challenges in green growth in Vietnam*. Available at: <https://www.technologymag.net/ba-thach-thuc-trong-phat-trien-cong-nghiep-xanh-o-viet-nam/>

⁵ Brauer, M. et al. 2017, for the Global Burden of Disease Study 2017. Available at: <https://data.worldbank.org/indicator/EN.ATM.PM25.MC.ZS?view=map>

⁶ OECD (2019), *Air pollution exposure (indicator)*. Available at: <https://doi.org/10.1787/8d9d9cc33-en> [Accessed on 05 December 2019]

⁷ Vietnamnet Magazine (2017), *Vietnam ranks 27th in greenhouse gas emissions*. Available at: <https://english.vietnamnet.vn/fms/environment/185103/vietnam-ranks-27th-in-greenhouse-gas-emissions.html>

⁸ Cristina Lago (2018), *How Vietnam is investing in green tech to fix its coal problem*. Available at: <https://www.cio.com/article/3299039/how-vietnam-is-investing-in-green-tech-to-fix-its-coal-problem.html>

⁹ Koushan Das (2019), *Renewables in Vietnam: Current Opportunities and Future Outlook*. Available at: <https://www.vietnam-briefing.com/news/vietnams-push-for-renewable-energy.html/>



energy consumption, and rejuvenate the green economy sector.¹⁰ Notably, the state ratified a growth strategy for transforming Vietnam's renewable energy by 2030 with the capacity to extend it to 2050. The state further fueled the development of the renewable energy sector by supporting the development of biomass energy, hydropower, solar energy, and wind energy.¹¹ Even though Vietnam's potential to become a major player in renewable energy is legitimate, the current growth trend in renewable energy is low compared with the nation's potential.¹² Various hurdles in the development of green energy, especially the harmonization of green and economic growth, have been encountered. Le Minh Duc, the head of Department of Environment and Sustainable development, Institute of Strategy and Industrial policy, recently commented that the major challenges that Vietnam encounters in the development of the green industry are a lack of institutions, capacity, and awareness.¹³

Patent data is ideal for identifying "environmental" innovation. It allows very specific "environmental" technologies to be rapidly identified. It also allows particular 'environmental' technologies to be identified further supporting green energy development. The OECD developed the following green growth indicators for innovation and technology-based on patent data: technology diffusion, indicators on technology development, and international collaboration in technology development.¹⁴

To isolate the primary trends for patent landscape in Vietnam's green energy field, an analysis of the available statistics was conducted. The evaluation incorporates the International Patent Classification (IPC) Green Inventory of WIPO¹⁵ to describe green energy inventions using Vietnam Intellectual Property Research Institute (VIPRI) IP platform database¹⁶. The analysis conducted in this paper deals with patent publications up to 2018.

Patent Landscape

The findings indicate that the number of green tech inventions filed in Vietnam has been increasing at an extraordinary pace since the middle 2000s. Vietnam has made long strides in the development of patenting green technologies for both domestic and foreign patent applications. The findings reveal that out of the global patent applications Japan had 23%, United States 15%, Vietnam 13%, Germany 8.7% and South Korea 5.3% of patent applicants filed during the period. Dow Agrosciences, Syngenta, Honda, Bayer Cropscience and BASF SE were the top patent applicants. Regarding Vietnam applicants, Institute of Biotechnology and Institute of Environmental Engineering from Vietnamese Academy of Science and Technology, Hanoi University of Science and Technology, Biotechnology JSC and VietNam Science and Technology Joint Stock Company (BUSADCO) were the leaders in patenting green technologies in Vietnam. Out of the VN patent applications explored in this research relating to green technologies, 43.8 % related to individual applicants, 25.6 % enterprises/corporations, and 30.44% institutes/universities. The following is a detailed analysis of the findings of this research.

¹⁰ Meessen, Jerome & Croizer, Claude & Verle, Paul. (2015). The Viet Nam Green Growth Strategy: A review of specificities, indicators and research perspectives. Available at:

<https://www.researchgate.net/publication/280004669> The Viet Nam Green Growth Strategy A review of specificities indicators and research perspectives

¹¹ Prime Minister's Decision 2068/QĐ-TTg on approval of the development strategy of renewable energy of Vietnam by 2030 with a vision to 2010, 25 Nov 2015

¹² Cristina Lago (2018), *How Vietnam is investing in green tech to fix its coal problem*. Available at <https://www.cio.com/article/3299039/how-vietnam-is-investing-in-green-tech-to-fix-its-coal-problem.html>

¹³ *Three challenges in green growth in Vietnam*. Available at: <https://www.technologymag.net/ba-thach-thuc-trong-phat-trien-cong-nghiep-xanh-o-viet-nam/>

¹⁴ Hašič, I. and M. Migotto (2015), "Measuring environmental innovation using patent data", OECD Environment Working Papers, No. 89, OECD Publishing, Paris, <https://doi.org/10.1787/5js009kf48xw-en>.

¹⁵ WIPO, *IPC Green Inventory*. Available at: https://www.wipo.int/classifications/ipc/en/green_inventory/

¹⁶ Intellectual Property Data and Service Platform - Vietnam Intellectual Property Research Institute (VIPRI). Available at: <https://ipplatform.gov.vn/>

Green Technology Patent Distribution by Publication Year

The following figure shows the number of green technology-related patent and patent grants filed in Vietnam from 1990-2018. The data used for statistical analysis extends to 25 August 2019.



Figure 1: green technology-related patent filings and patent grants in Vietnam from 1990-2018

There is a staggering increase in the number of green technology-related patents application filed in Vietnam over the years. Approximately 10,000 patents/patent application had been filed by 25 August 2019. Prior to 1996 and during the early 1990s, only a few green-tech inventions were filed in Vietnam. The patents did not exceed 100 cases each year. Nevertheless, between 1996 and 2004, patent applications grew enormously compared with the preceding period with the greatest number of cases recorded in 2001 (179 applications). Astoundingly, the number of patent application in 2005 increased by 72% from the previous year and a new era of growth in patent filings rocked the period 2005-2013. In 2005, there were 270 patent applications compared to 800 applications in 2013. Patent application throughout the period grew by 37% every year. Between 2013 and 2016, green-tech patent application increased steadily: in 2017 patent filings increased by 16% from the previous year, but declined in 2018 (906 in 2017 and 886 in 2018). The total number of green-tech patents approved in the 1990s was 144/10,413 (approximately 1.38 %), which is considerably low when compared with the total number of patent filings. In the subsequent ten-year period (2000-2010), the number of green-tech patents granted increased by 6.71 times (967/144) more than the former period. The number of patents granted increases gradually from 2011 to 2018 (1806 patent granted), with 225.75 patent granted per year which is nearly twice as much as the previous period.

Green-tech Patents Distribution by State

Green-tech patents are only found in certain countries since majority have not adopted green energy initiatives. Japan, the US, Vietnam, Germany and South Korea account for over 66% of all green technology patents. Japan has filed approximately 2393 green-tech patent applications and has the largest patent applications in green technology in Vietnam. The United States, Vietnam, Germany, and South Korea rank second, third, and fourth with 1514, 1343, 871 and 534 patent applications filed, respectively. Out of the top 10 countries in green-tech

patent application, France, Japan, Vietnam have the highest granting numbers (in particular, 36.4%, 35.5% and 30.3%, respectively), while South Korea has the lowest granting number (around 14.2%) despite being in the top five countries in regards to patent filings. Vietnam is the third largest patent country with 1343 green-tech patent applications. The following figure outlines the total number of green-tech patent applications filed in the top tenth jurisdictions in Vietnam.

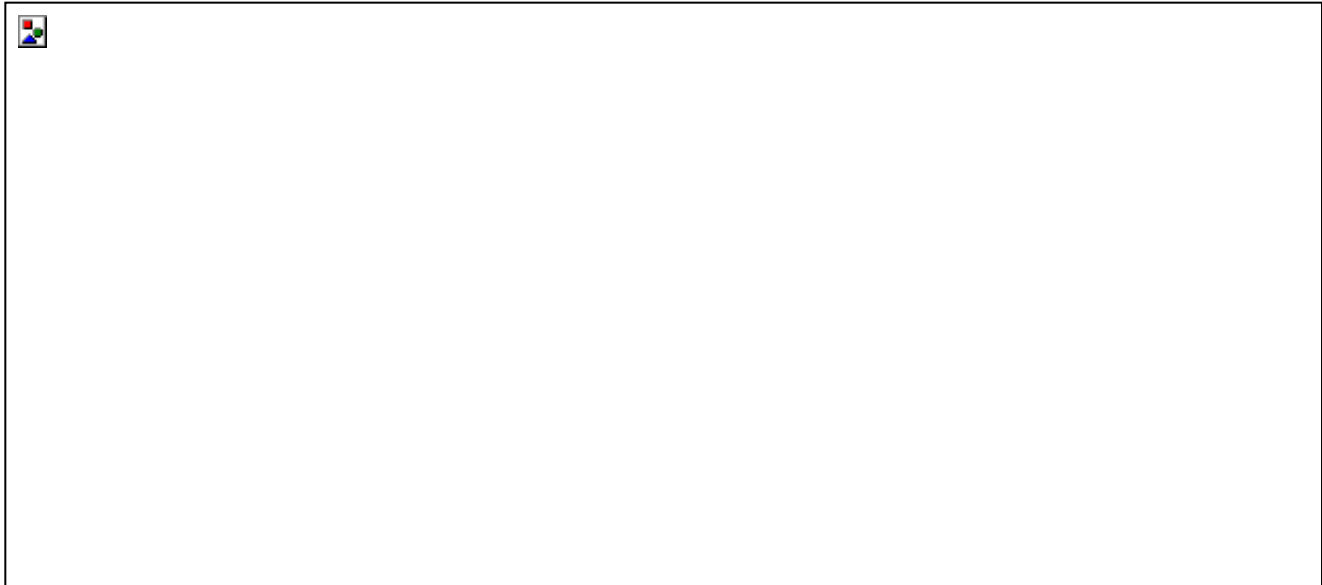


Figure 2: Green-tech Patent Applications by State

According to Figure 3 below, Japan, the US, and Vietnam are the three top countries in regards to filing green-tech patent applications. Japan’s patent applications increased significantly between 2009 and 2013 by approximately 19.8% every year. Attenuates increased by around 8.2% each year during the period 2013 to 2016. Japan maintained position 1 and achieved its previous patent growth of 14.5 % per year in two recent years 2017-2018. The United States was ranked 2nd based on 2009-2013 patent application statistics. The average patent application growth rate for each year during the period was 19.4% although fluctuated over that period. Vietnam scooped position 3 displacing Germany with its promising growth rate of 24.5% each year for the period 2009-2016. Currently, Vietnam competes with the United States and Japan concerning green-tech patent applications. Prior to 2015, South Korea recorded low levels of patent application. However, the country’s patent applications increased between 2015 and 2018 by approximately 21.5%, consequently being ranked 2nd in 2018. Figure 3 below highlights the number of green-tech patent applications filed from 2009 to 2018 in the top seven countries.



Figure 3: Green-tech patent applications (2009 -2018)

Distribution of Green-tech Patent Application by patent applicants

Figure 4 below depicts the number of green-tech patent applications filed and patents granted among the top tenth patent applicants from 2009 to 2019. The top ten patent applicants featured in the figure below had the largest patent applications related to green inventions. Dow Agrosciences, Syngenta, Honda, Bayer Cropscience and BASF SE were the leading patent applicants in Vietnam. However, Yamaha, Honda and Bayer Intellectual Property GmbH had notably greater numbers of patents granted (68.75%, 61% and 40.7%, respectively) compared to the other applicants. Dow Agrosciences, Bayer Cropscience, and BASF SE had the lowest number of patents granted (2.7%, 5.9%, and 6%, respectively) even though their patent applications figures are still high.



No Vietnamese applicants featured in this list

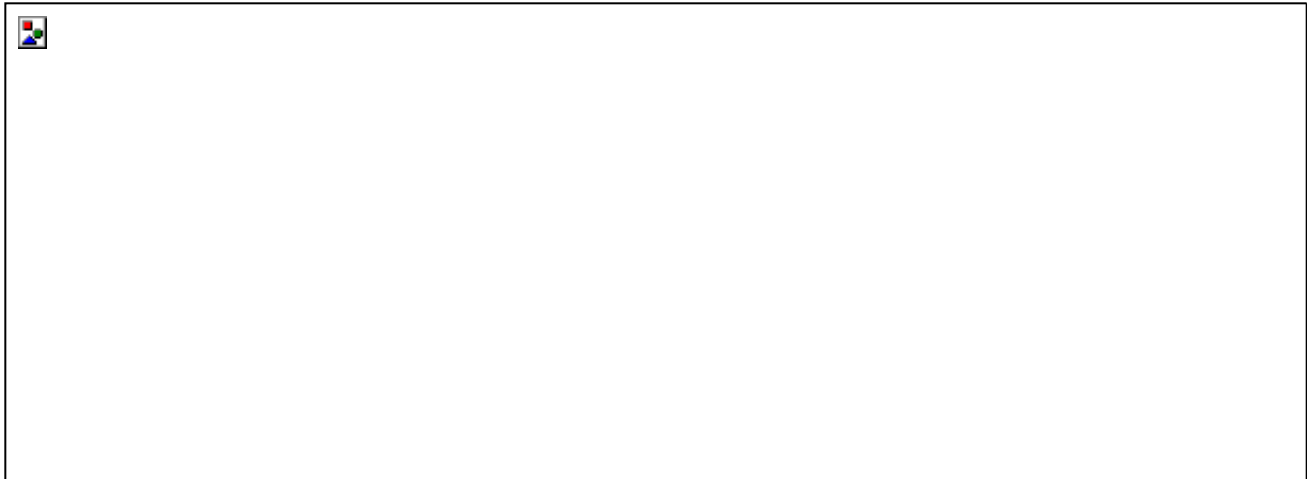


Figure 4: Green-tech patent applications filed and patents granted among the top tenth patent applicants from 2009 -25 July 2019

Patent Application Distribution by Technical Fields

Figure 5 below outlines the dominant types of Green-tech inventions in Vietnam based on data extending 25 October 2019. IPC classification is leveraged to help in observing the chief areas of green-technology technologies filed in Vietnam.



Figure 5: Major types of Green-Tech inventions in Vietnam

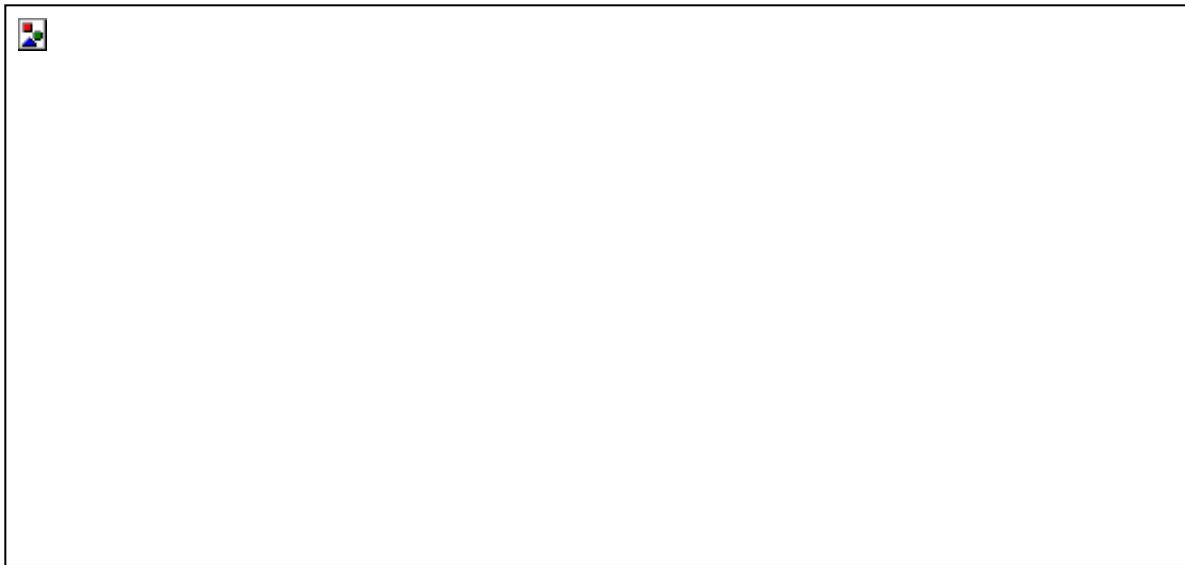


Figure 6: Green Energy Patent Application by Sector

The findings in figure 6 indicate that the following fields lead in the application of green energy patents: Agriculture/Forestry (33%), Alternative Energy Production (25%) and Waste Management (21%). Some of the fields that recorded a low number of patent applications include Energy Conversation (5%) and Administrative (5%). The Nuclear Power Generation field had only 1% of patent applications. Over the years, patenting in fields such as Agriculture/Forestry and Waste Management have been declining, even though the fields still account for the biggest growth in all green energy technologies. The following table outlines the top leading applicants for top sub-fields in green energy.

Rank	Sub-field	Top Leading Applicants
1	Agriculture/Forestry	Syngenta Bayer CropScience Dow Agrosciences BASF Sumitomo Chemical
2	Alternative Energy Production	Dow AgroSciences Ajinomoto Institute of Biotechnology (Vietnam) Mosanto BASF Plant Science
3	Waste Management	Unilever Toshiba Kobelco Eco-solutions ExxonMobil Upstream Research Mitsubishi Hitachi Power Systems

Table 1: Top leading applicants for top sub-fields

Alternative Energy Patent Application Breakdown

The alternative energy fields account for approximately 25% of the total green energy invention. It is ranked position 3 in regards to patent applications with 76.77% being PCT international applications. The number of applications in this field increased in the period of 2005-2013. Applications grew annually by 18%, but decreased by 11% in 2014 and stabilized during the 2014 -2016 period. Inventions in biofuels, solar energy, wind energy, hydro energy and geothermal energy account for 60.64%, 14.42%, 10.1%, 6%, and 3.3%, respectively, of the total of alternative energy inventions production. Regarding biofuels’ inventions, there are 5.5 % of solid fuels, 9.7% liquid fuels, 5.8% of biogas, and 79% of biofuels derived from genetically engineered organisms. Green-tech inventions from Vietnamese applicants

The following figure illustrates using percentage chart the chief forms of Green-Tech inventions filed by Vietnamese Applicant (using data dating up-to 25 October 2019).

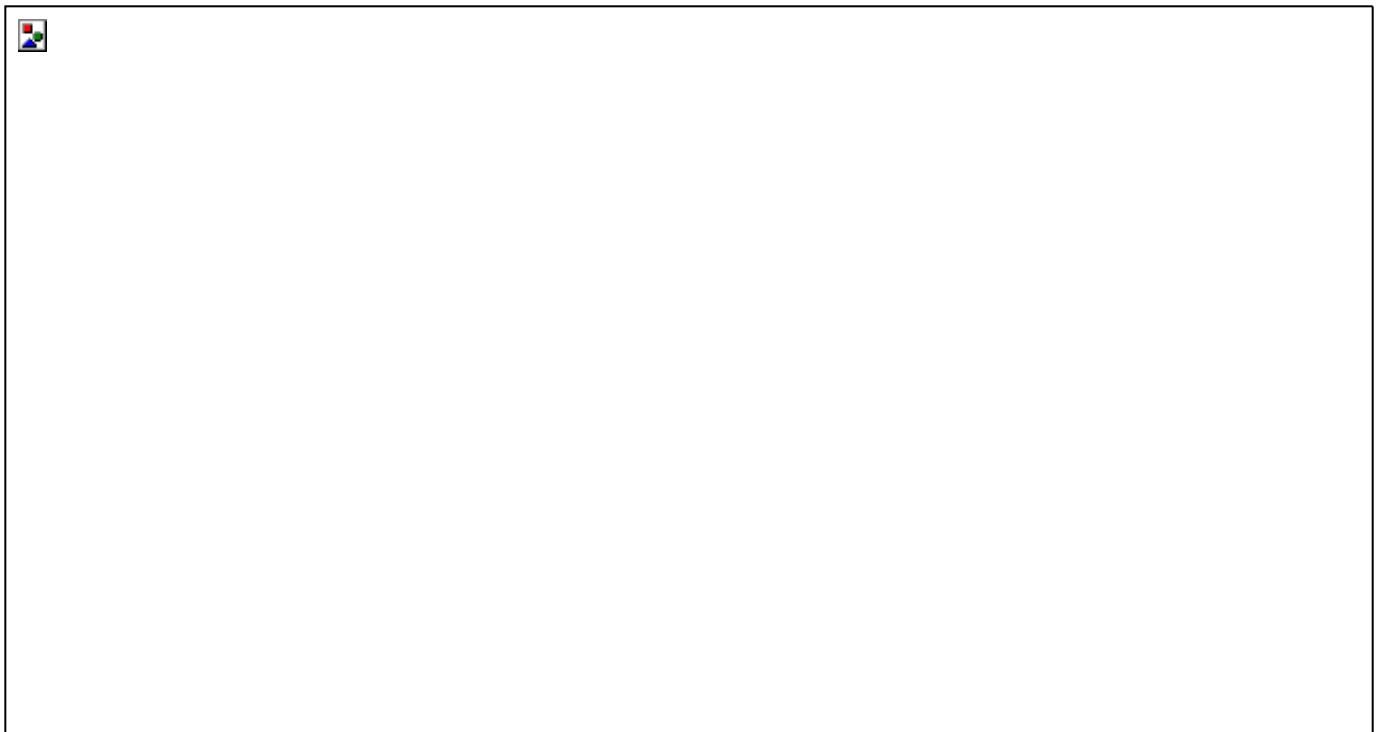


Figure 7: The major types of Green-Tech inventions filed by Vietnamese Applicant

The research highlights that Vietnam has an astounding number of green-tech inventions filed with 1,365 applications per total of 10,523 applications (12.9%). The major Green-tech inventions filed by Vietnamese applicants were: fields of Waste Management (38%), Alternative Energy Production (25%) and Agriculture/Forestry (24%). The fields that have the lowest number of applications are: Transportation (5%), Energy Conversation (5%) and Administrative (5%). No Vietnamese applicants for the field of Nuclear Power Generation featured in this research.

VN patent applications relating to green technologies, individual applicants accounted for 43.8 % while enterprises/ corporations (25.6 %), and institutes/universities (30.44%). These figures are significant since they

explain the lack of interest by local companies in investing in clean energy-related projects¹⁷. Perhaps, this is why companies have not exploited the commerciality of green patents.

Regarding alternative energy, Vietnamese inventions in biofuels, wind energy, hydro energy, solar energy, and geothermal energy accounted for 41.5%, 21.1%, 17.69%, 16.2%, 1.2%, respectively, of the total of inventions of alternative energy. In the biofuels Vietnamese inventions, there were 13.6 % of solid fuels, 25.44 of liquid fuels, 9.4 % of biogas, and 50.88 % of biofuels from genetically engineered organisms. The following figure summarizes Vietnamese leading patent applicants in the field of green technology inventions.



Figure 8: Green-tech patent publications filed by Vietnamese applicants

Conclusion

Sustainable development has a very significant potential to transform the society and economy of a nation. Vietnam has exemplified a strong commitment towards the development of alternative forms of energy as demonstrated by the growing number of patent applications. However, more efforts are required to exploit green technology.

¹⁷ <https://vietnamnews.vn/society/482531/viet-nams-efforts-for-green-growth-need-more-active-moves.html#fT2x4ZLHmTcT9CBf.97>

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