Patent Seekers

Climate Change
A Patent Perspective Part 2:

Automotive IP -
Driving Towards a Greener Future

Table of Contents

Introduction

In the first instalment of this series of reports, Patent Seekers provided a generic overview of climate change from a patent perspective[1], which identified a broad spectrum of technologies in the combat against the climate crisis. It has become apparent that the automotive industry will play a major role in future efforts against global warming, as the industrial revolution sparked an era of fossil fuel consumption. Unfortunately, this has been at the expense of the environment, as climate change has catalysed ecological extinction around the globe. Such repercussions have put a spotlight on the automotive industry, although government policies will undoubtably affect developments in this area by influencing the consumer market. In this report we will explore how innovation is driving the motor industry towards a green future and discover the key players shaping the patent landscape.

Patent filing analysis

The patent landscape depicted in Figure 1 illustrates a rising trend in patent filings, in accordance with growing concerns regarding the future of our planet. However, the filing activity appears to have stalled between years 2013 and 2015. This period coincides with a scandal in 2015, wherein diesel engines were claimed to be more environmentally friendly[2], which may have negatively affected the demand for new green technology. It appears that interest was reignited following the exposure of the true impact of diesel engines upon the environment, as shown by the spike in patent filings in 2016. Considering the evident necessity for eco-friendly technology, it is suprising to see a sharp downturn in 2017 and 2018. Perhaps such a drastic downturn may be a symptom of a major problem underpinning automotive innovation. It could be that there is a lack of benefit from a consumer point of view, as several publications have found combustion automobiles to be more cost-effective than alternative options[3, 4], which may have been excacerbated by electronic vehicles suffering from a lack of driving range, as well as a defficient charging infrastructure and prolonged charging times, which can be particularly cumbersome during longer journeys. These factors continued to pose a threat for developments in this area until late 2018, without any substantial investment from governments around the globe[7]. It remains to be seen if new efforts will renew patent activity within this field, as the reduction in patent filings after 2018 is most likely the result of applications yet to be published that would be claiming these years as priority.

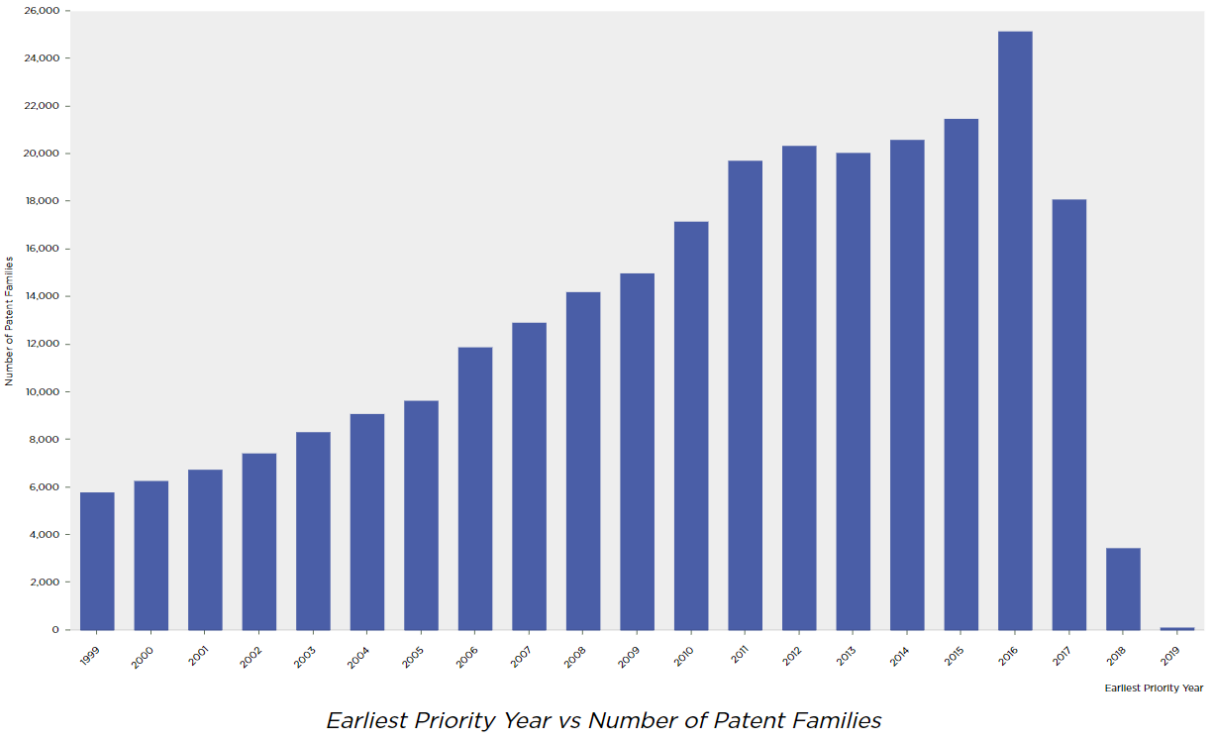

Figure 1. Worldwide climate change mitigation patent filings related to transportation between 1999-2019

Classification analysis

A look at the key cooperative patent classifications (CPCs) within this field will provide us with an insight into the main areas driving innovation, as shown by Figure 2. The main classifications appear to relate to the propulsion of electrically-propelled vehicles (represented by the B60L classifications), wherein the top three classifications identified include:

Y02T10/7005	Batteries
B60L50/50	Using propulsion power supplied by batteries or fuel cells
B60L11/18	Using Power Supplied From Primary Cells, Secondary Cells, Or Fuel Cells

These classifications appear to account for 34% of the total number of patent families in the top 20 identified CPCs. The more concentrated patenting activity in these areas complements the introduction of more stringent emission policies[8], for which electric vehicles appear to be the prime candidate, due to their renewable nature and efficiency: electric vehicles are able to utilise over 50% of their electrical energy to power the wheels, whereas fuel-powered vehicles are only able to convert approximately 17%–21% of the energy stored in gasoline[9]. Interestingly, the classification analysis has also identified hybrid vehicles as a key technology for lowering emissions. The emergence of this area could be driven by the market, as hybrid vehicles overcome several drawbacks associated with electric vehicles by avoiding the necessity for charging points through the provision of fuel propulsion systems and auxiliary means that are capable of recharging the batteries[10]. While the growing need for alternative modes of transport and government initiatives are likely to facilitate the development of infrastructure, it will be exciting to see how automotive manufacturers will overcome the challenges posed by electric vehicles.

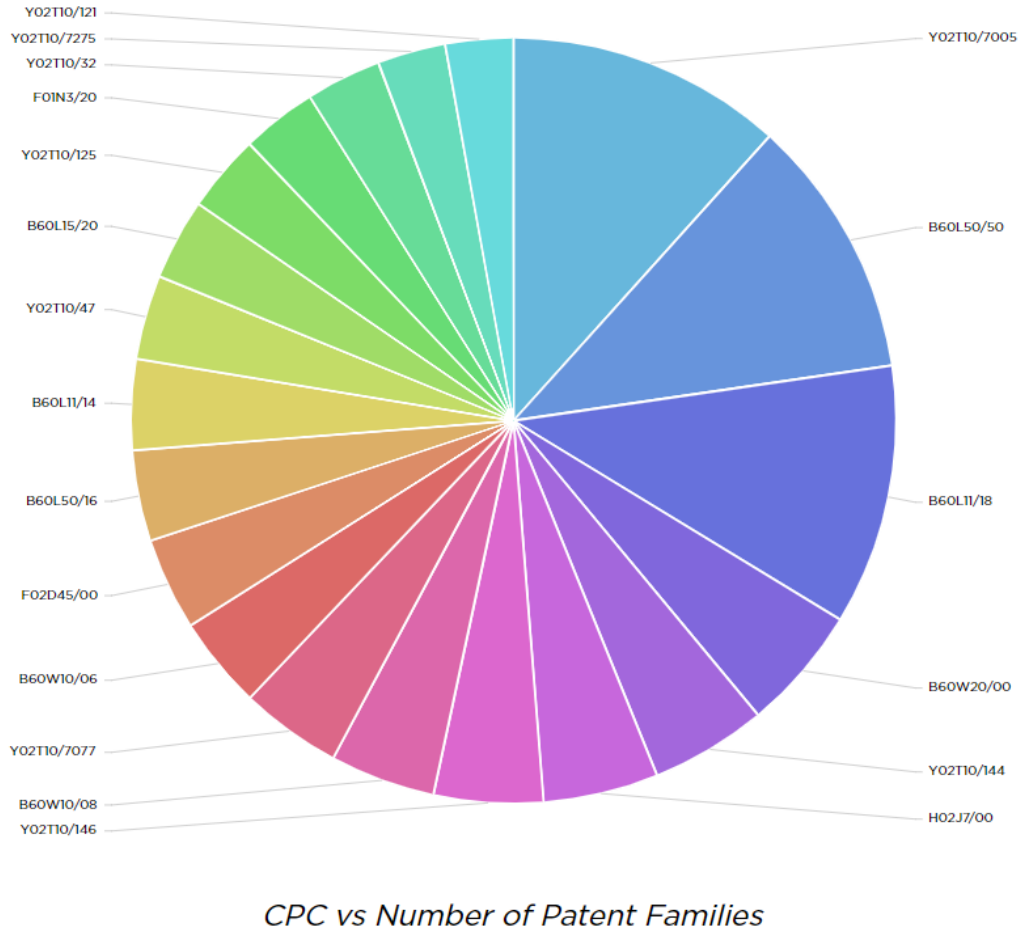

Figure 2. Number of patent families in the top 20 Cooperative Patent Classifications.

Note: See Appendix A for full classification definitions.

Global analysis

The global spread of patent filings appears to be most concentrated in Japan, with USA, China and Germany also having a considerable presence in the field. This appears to be supported by analysis of electric vehicle registrations by country, which show USA, China and Germany having high numbers of registrations[11]. Interestingly, Japan does not appear to have a high level of registration, which could suggest that Japanese companies may be aiming to take advantage of larger markets around the globe, one example could be China due to its geographical proximity. The size of global markets will likely be influenced by government incentives for purchasing or owning an electronic vehicle, such incentives can be seen in USA, China and Germany, which include tax credits, purchase incentives and scrappage schemes. Socio-economic factors are also likely to play a role in the size of the market, as electric vehicles can be more expensive than comparable fuel-powered vehicles, which could explain why the more socio-economically affluent areas of the globe are leading the charge in the manufacture of electric vehicles[12, 13]. Overall, our global analysis appears to show an association between the geography of electric vehicle markets and patent filings, as larger markets are likely to exhibit more fierce competition and more lucrative commercialisation, which make IP highly advantageous.

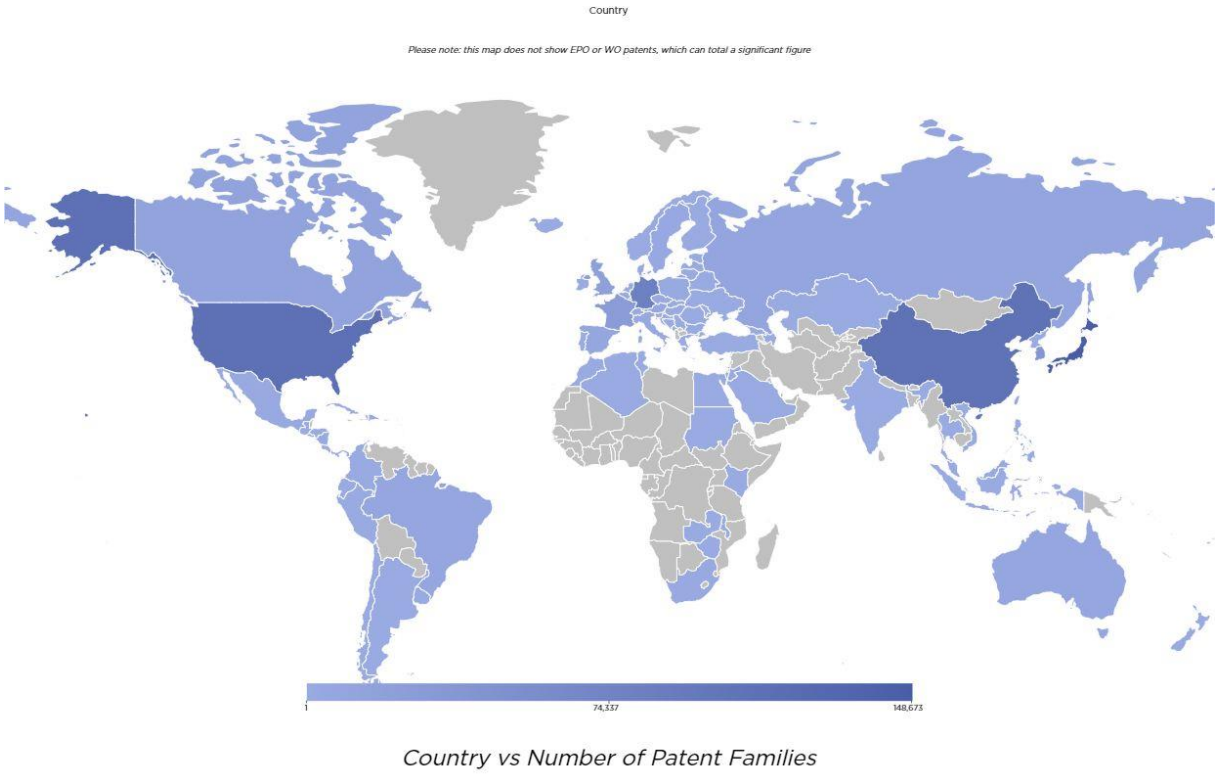

Figure 3. Global distribution of climate change mitigation patent filings related to transportation.

Assignee analysis

Despite close competition between Japan, China, US and Germany, it appears that the top three assignees are all Japanese, as shown by Figure 4, wherein Toyota appears to have established a profound dominance in the market. Toyota has even provided royalty-free access to approximately 24,000 patents it holds pertaining to vehicles using electrification technology [14], which provides us with an insight into the scale of its monopoly. An agreement between Toyota, Mazda and Denso to collaborate on affordable electric vehicle technology may have also contributed towards the transformation of the Japanese automotive industry into a world leader in green technology[15]. A further look at the remaining assignees reveals multiple similarities with analysis performed in our previous article on climate change, which is not surprising considering the major impact of transportation upon the climate. It is also evident that a large proportion of the assignees are of Asian origin, which may be a result of the Asian economies having a larger share of the market[9].

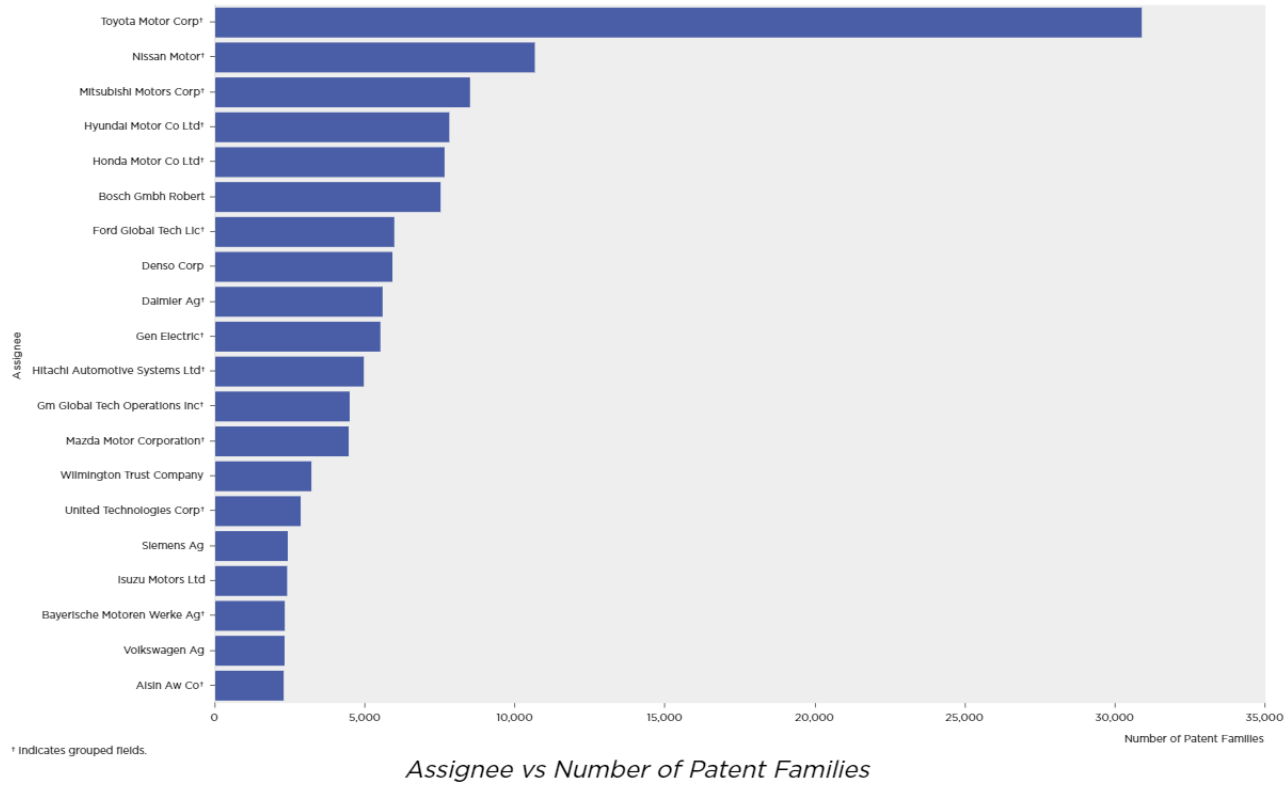

Figure 4. Transport-related patent filings by the top 20 assignees.

Conclusion

Innovation of automotive propulsion appears to be moving through a gradual gear change towards clean energy, which has been facilitated by stringent government policies. Our analysis appears to support the evident drive towards a green future, although recent slumps in patent filings have cast doubt, as electric vehicles have been plagued by problems. Fortunately, the inadequacies appear to have been addressed, which seems to have translated in significant improvements in electric vehicle registrations across the globe[11]. Interestingly, there appears to be a correlation between electric vehicle registrations and our global patent filings analysis, suggesting that geography of the market may have created hotspots of innovation. It will be exciting to see the direction of global expansion in environmental technology, as it will be influenced by a complex interplay of factors. Global adoption of alternative energy sources will be imperative in the remediation of ecosystems, which has been highlighted by the cooperation of market leaders through royalty-free patents and initiatives.

Will recent efforts put Intellectual Property back on track?

A myriad of other questions remain, yet only time will tell if the interwoven efforts of industry and government leaders will be enough to save life on our planet.

Contacts

Authors

Filip Silvestre
Senior Patent Analyst
Biotechnology Department
Patent Seekers (UK and North America)
filipsilvestre@patentseekers.com

Nathanael Ashworth
Patent Analyst
Biotechnology Department
Patent Seekers (UK and North America)
nathanaelashworth@patentseekers.com

With thanks to:

Alec Griffiths
IP Manager
Biotechnology Department
Patent Seekers (UK and North America)
alecgriffiths@patentseekers.com

Dean Parry
Technical Director
Patent Seekers (UK and North America)
mail@patentseekers.com

Timothy Parry
Technical Director
Patent Seekers (UK and North America)
mail@patentseekers.com

Make sure to follow our LinkedIn page to keep up to date with patent insights and papers.

https://www.linkedin.com/company/patent-seekers-ltd/

References

All figures within this report were produced using PatWorld, www.patworld.com

[1] https://patentseekers.com/gb/wp-content/uploads/sites/12/Climate-Change-A-Patent-Perspective.-Part-1-An-Overview.pdf

[2] https://ieeexplore.ieee.org/abstract/document/8605020/

[3] https://www.blogmotori.com/wp-content/uploads/2017/07/EV-Price-Parity-Report_BlogMotori_COM_MobilitaSostenibile_IT.pdf

[4] https://www.sciencedirect.com/science/article/abs/pii/S0301421518302404

[5] https://ieeexplore.ieee.org/abstract/document/8559871/

[6] https://www.automotiveworld.com/articles/electric-vehicle-sales-a-global-snapshot-in-uncertain-times/

[7] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3491629

[8] https://www.carbonbrief.org/mapped-climate-change-laws-around-world

[9] https://www.alliedmarketresearch.com/electric-vehicle-market

[10] https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work

[11] https://www.ev-volumes.com/country/total-world-plug-in-vehicle-volumes/?fbclid=IwAR3yzlj8flklLEvxmrvEOjjI0XsdZcVBKYULnVcVyAFGGR8n_Zu_zEUOrUE

[12] https://journals.sagepub.com/doi/10.3141/2394-14

[13] https://espace.curtin.edu.au/handle/20.500.11937/17321

[14] https://www.japantimes.co.jp/news/2019/04/03/business/corporate-business/toyota-allow-free-access-24000-hybrid-electric-vehicle-tech-patents-boost-market/#.Xsfzh2hKiUl

[15] https://www.statista.com/topics/5628/electric-vehicles-in-japan/

Appendix A – Cooperative Patent Classifications (CPC) Discussed / Found

Classifications specifically mentioned in this report have been highlighted in yellow.

B60L11/00	Electric propulsion with power supplied within the vehicle
B60L11/02	using engine-driven generators
B60L11/14	with provision for direct mechanical propulsion
B60L11/18	using power supplied from primary cells, secondary cells, or fuel cells
B60L15/00	Methods, circuits, or devices for controlling the traction-motor speed of electrically-propelled vehicles
B60L15/20	for control of the vehicle or its driving motor to achieve a desired performance, e.g. speed, torque, programmed variation of speed
B60L50/00	Electric propulsion with power supplied within the vehicle
B60L50/10	using propulsion power supplied by engine-driven generators, e.g. generators driven by combustion engines
B60L50/16	with provision for separate direct mechanical propulsion
B60L50/50	using propulsion power supplied by batteries or fuel cells
B60W10/00	Conjoint control of vehicle sub-units of different type or different function
B60W10/06	including control of combustion engines
B60W10/08	including control of electric propulsion units, e.g. motors or generators
B60W20/00	Control systems specially adapted for hybrid vehicles
F01N3/00	Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust
F01N3/08	for rendering innocuous
F01N3/10	by thermal or catalytic conversion of noxious components of exhaust
F01N3/18	characterised by methods of operation; Control
F01N3/20	specially adapted for catalytic conversion; Methods of operation or control of catalytic converters
F02D45/00	Electrical control not provided for in groups F02D41/00 - F02D43/00
H02J7/00	Circuit arrangements for charging or depolarising batteries or for supplying loads from batteries
Y02T10/00	Road transport of goods or passengers
Y02T10/10	Internal combustion engine [ICE] based vehicles
Y02T10/12	Technologies for the improvement of indicated efficiency of a conventional ICE
Y02T10/121	Adding non fuel substances or small quantities of secondary fuel to fuel, air or fuel/air mixture
Y02T10/125	Combustion chambers and charge mixing enhancing inside the combustion chamber
Y02T10/14	Technologies for the improvement of mechanical efficiency of a conventional ICE
Y02T10/144	Non naturally aspirated engines, e.g. turbocharging, supercharging
Y02T10/146	Charge mixing enhancing outside the combustion chamber
Y02T10/30	Use of alternative fuels
Y02T10/32	Gaseous fuels
Y02T10/40	Engine management systems
Y02T10/47	Exhaust feedback
Y02T10/60	Other road transportation technologies with climate change mitigation effect
Y02T10/70	Energy storage for electromobility
Y02T10/7005	Batteries
Y02T10/7072	Electromobility specific charging systems or methods for batteries, ultracapacitors, supercapacitors or double-layer capacitors
Y02T10/7077	on board the vehicle
Y02T10/72	Electric energy management in electromobility
Y02T10/7258	Optimisation of vehicle performance
Y02T10/7275	Desired performance achievement