



Patent Seekers

Climate Change A Patent Perspective Part 1: An Overview

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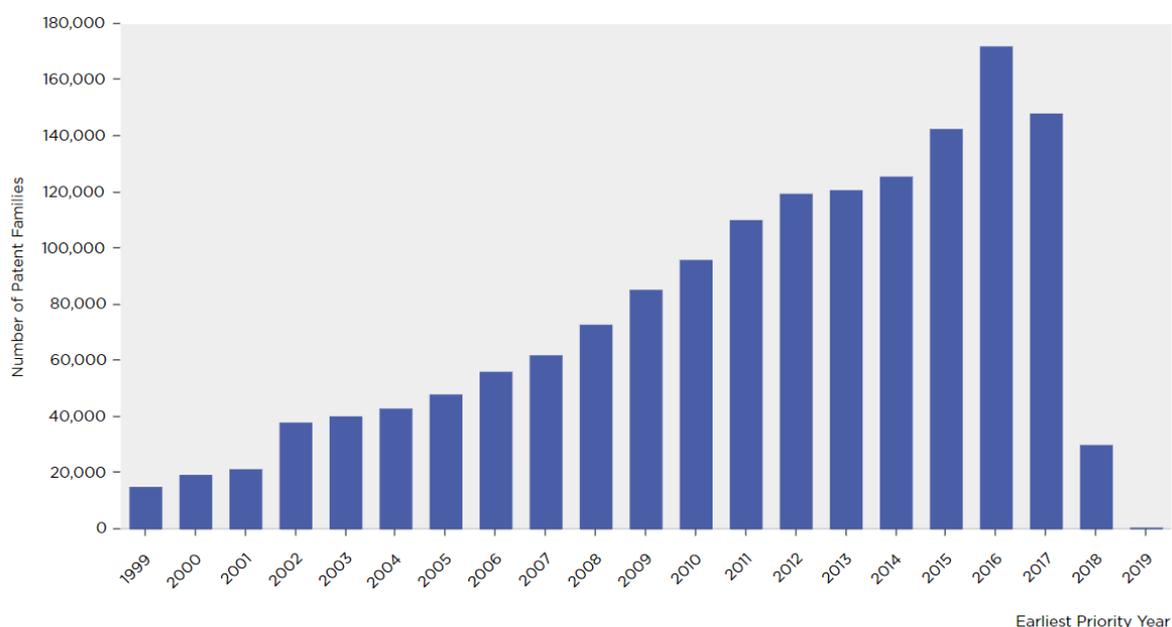
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Introduction

Climate change and the declining state of the environment have been issues at the forefront of people's minds this past decade, posing a significant threat to current and future lives. Now, more than ever, with the coronavirus pandemic sweeping the world and the global lockdown that has ensued, we can see first-hand how the reduction in manufacturing, travel and consumerism in general is benefitting the environment^[1, 2]. We have also seen the extreme consequences of climate change in the recent year, as wildfires have unprecedentedly spread across California and Australia. Numerous political and business initiatives and goals have been discussed, launched, missed and even withdrawn in some cases as governments seek both a local and global approach to this problem^[3, 4]. Intellectual property will have a key role in shaping the future and making a difference in our efforts to curb the effects of climate change as innovative, new technologies will be one of the greatest weapons in our arsenal. But who is actually trying to make a difference? What exactly are they doing to accomplish this? Over the next couple of months Patent Seekers will be investigating the patents that are supporting efforts to combat climate change in a multi-part series of reports. In this first report we will provide a broad overview of the patents behind the technology being used to combat climate change.

Patent filing analysis

Climate change presents a major threat to the future of our planet. Fortunately, it appears that the growing demand for global warming mitigation technologies is proportionately reflected by the numbers of patents filed over the last 20 years in this area, as shown by Figure 1. A steady increase in patent filings can be observed between years 1999-2014, with a more rapid increase in years 2015-2016 that has accounted for approximately 20% of all patent filings. Considering the current long-term predictions of global warming^[5] and the projected increase in renewable electricity generation^[6], it may be rational to expect a continuation in the current trend. However, there appears to be a decrease in the rate of patent filings in 2017 that may be indicative of an uncertain future, at least in the short-term, which is likely to be exacerbated by the current COVID-19 pandemic. The more significant reduction in patent filings between 2018-2019 is most likely the result of applications yet to be published that would be claiming these years as priority. Although government policies appear to affect growth in this area^[7], patent activity is likely to be influenced by a plethora of factors, making it difficult to decipher the cause and future direction of patent activity.



Earliest Priority Year vs Number of Patent Families

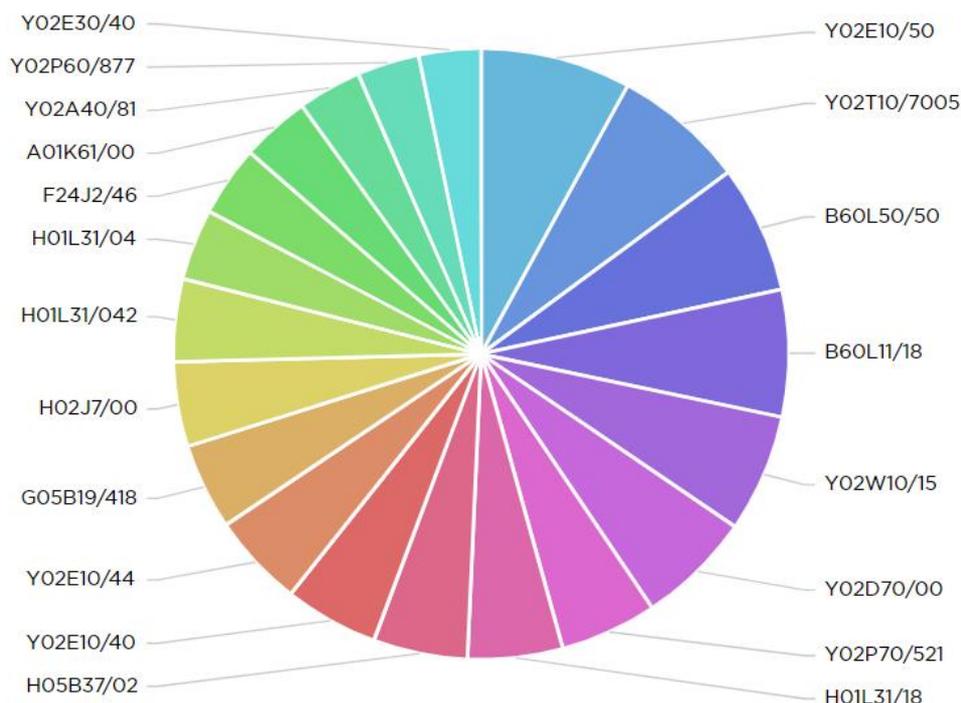
Figure 1. Worldwide climate change-related patent filings between 1999-2019.

Classification analysis

In order to dissect the rising trend in patent filings in more detail, we have analysed the key cooperative patent classifications (CPCs) within this field, to determine the main areas driving innovation, as shown by Figure 2. The primary classifications identified relate to technologies for mitigation or adaptation against climate change (represented by the Y02 classifications) and vehicles in general (represented by B60 classifications), wherein the top three classifications appear to be:

- Y02E10/50 Photovoltaic [PV] energy
- Y02T10/7005 Batteries
- B60L50/50 using propulsion power supplied by batteries or fuel cells

The discovery of alternative energy sources is a major focus of current research, as our dependence on fossil fuels is not sustainable and has contributed towards climate change^[4,6]. Energy is an essential driver of economic growth, hence the development of technology that can meet our demands whilst simultaneously achieving zero greenhouse gas emissions is of paramount importance. The patent classification analysis appears to indicate that photovoltaic energy will be a key technology for us in achieving this target, which is further complemented by data from the Centre for Climate and Energy Solutions: solar electricity generation is predicted to increase up to 48% of total U.S. renewable generation by 2050^[6]. The additional classifications identified also support the evident shift away from fossil fuels, as the automotive industry has pledged commitment to the production of electric and hydrogen powered vehicles^[8, 9].



CPC vs Number of Patent Families

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

Note: See Appendix A for full classification definitions

Global analysis

The importance of innovation in tackling climate change is further exemplified by Figure 3, which shows the majority of the world working towards this initiative. China appears to have the largest presence in the field, followed by Japan, the US and Germany. This is unsurprising when you factor in that China and the US generated the largest amounts of greenhouse gasses in the world, with Japan still in the top 5^[10]. That said, China is by far the largest contributor to climate change^[10] and is at the top spot for patent filings globally by a considerable margin. Most European countries appear to be approximately equal in number of patent families (with the exception of Germany), this may be indicative of a coordinated approach by the continent, perhaps as a result of a European Union initiative, such as the European Climate Change Programme^[11]. It is important to note that this map does not show EPO or WO patents, which could total a significant amount.

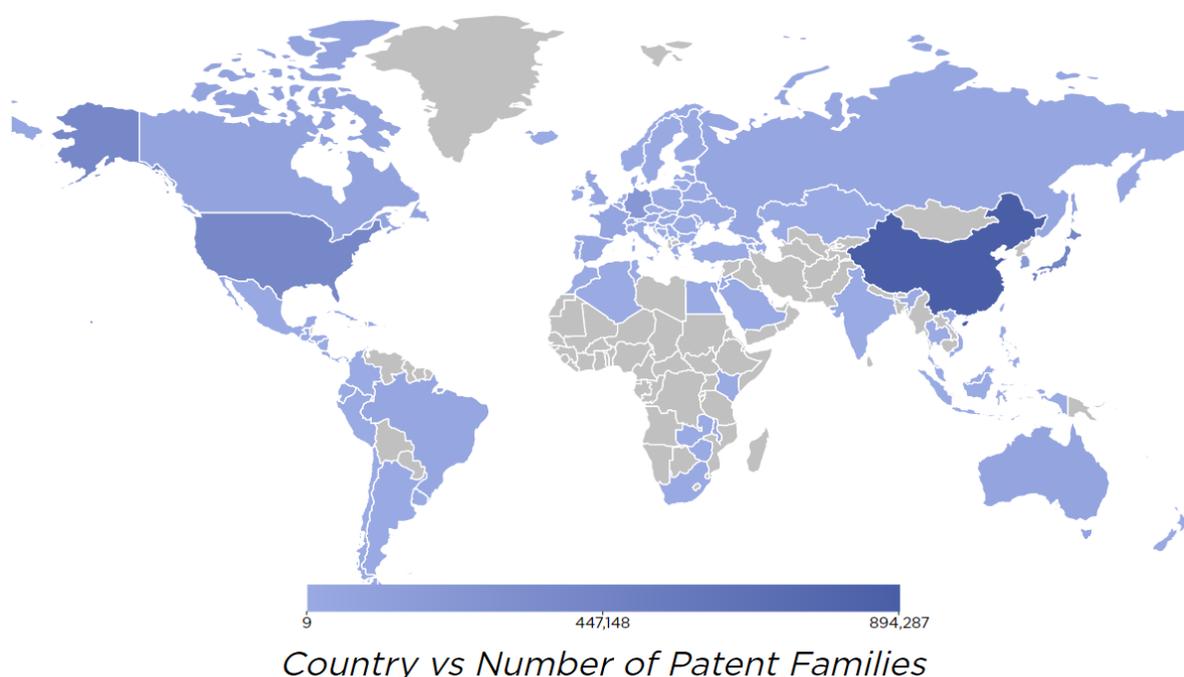
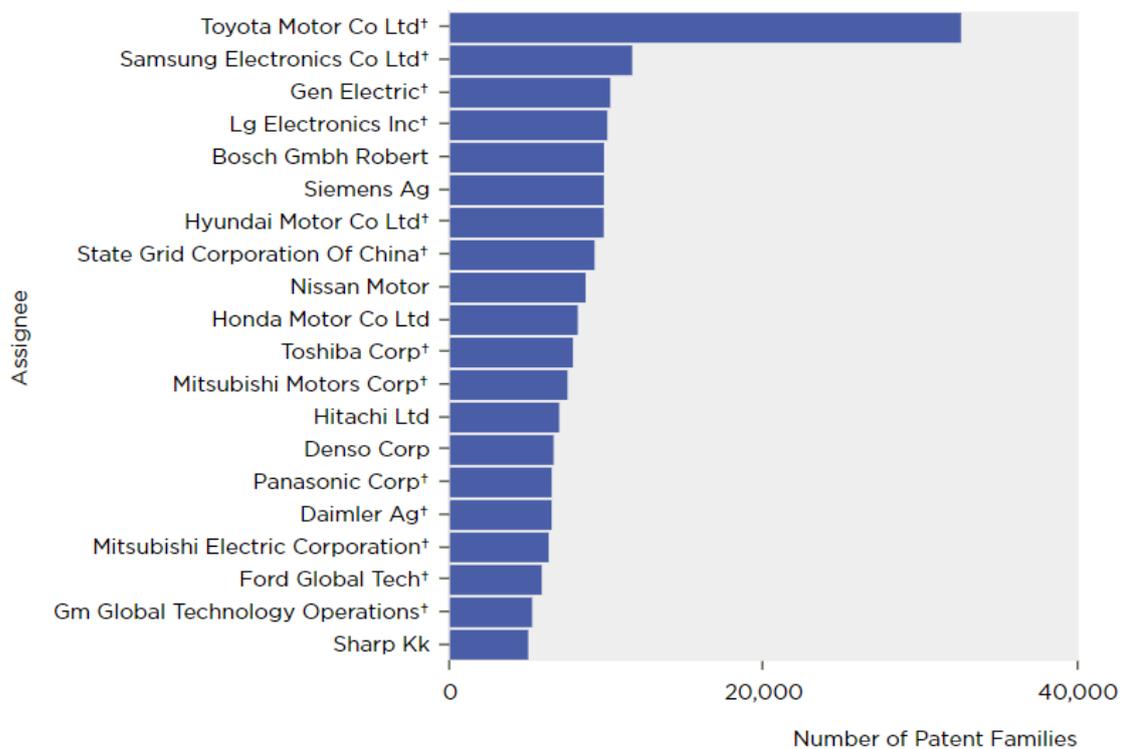


Figure 3. Global distribution of climate change-related patent filings.

Assignee analysis

Even though China appears to be the dominant force behind filing patents pertaining to climate change, the clear front running company is Toyota, a Japanese company. In fact, the top 7 companies all originate outside of China. The sheer difference between China and the next top countries (Japan and the US) shown in Figure 4 could be indicative of non-Chinese companies seeing an opportunity in the market with China's notoriously polluted air^[12]. In the case of the non-US companies it may also be that they are trying to take advantage of the significantly larger population of China. Out of the top 20 assignees, 9 are automotive related, with Toyota having a portfolio of more than double that of the next top assignee. These findings are less surprising when taking Figure 2 into consideration, given some of the most predominant classifications relate to vehicles and batteries in relation to vehicles. The strong presence of automotive companies could indicate that they are taking responsibility for transportation being an extensive greenhouse gas contributor^[13].



† indicates grouped fields.

Assignee vs Number of Patent Families

Figure 4. Number of patent filings by the top 20 assignees.

Conclusion

As a broad overview, it would appear that the automotive industry is the dominating force behind the fight against climate change. This apparent dominance could be as a result of a concerted effort towards electric vehicles^[14] and is likely to continue for some time. However, it will be interesting to see if the automotive industry falls from this lofty position once electric vehicles become a worldwide staple.

As the Covid-19 pandemic and the subsequent lockdown measures sweep the globe, climate change has inadvertently been thrown into the spotlight. However, it remains to be seen how and if the current pandemic will affect our attitude towards the climate. Perhaps being forced to remain indoors for so long in combination with having stark new statistics and information on the environmental and health benefits the lockdown has had^[2] will stimulate a new found respect and drive towards a cleaner future. On the other hand, the world may increase manufacturing, transport and subsequently emissions in order to counteract the negative economic consequences this pandemic has had.

It is clear that patents have already had a significant role in tackling climate change, and no doubt will continue to be important in spurring the degree of innovation necessary to save the environment and the lives of the people who are already experiencing the negative impacts of climate change. Though, it does leave the Intellectual Property world in a somewhat morally ambiguous position: though patents are vital for protecting and encouraging innovation, should some of the technology they protect be accessible to all if lives and the very future of the planet are at stake?

That said, it will be exciting to see what the charts display and what insights are gained when we delve deeper into the different areas of climate change technology in future reports.

Contacts

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

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

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

A01K61/00	Culture of aquatic animals
B60L11/00 B60L11/18	Electric Propulsion With Power Supplied Within The Vehicle Using Power Supplied From Primary Cells, Secondary Cells, Or Fuel Cells
B60L50/00 B60L50/50	Electric propulsion with power supplied within the vehicle using propulsion power supplied by batteries or fuel cells
F24J2/00 F24J2/46 F24J2/52	Use of solar heat, e.g. solar heat collectors Component parts, details or accessories of solar heat collectors Arrangement of mountings or supports
G05B19/00 G05B19/02 G05B19/418	Programme-control systems electric Total factory control, i.e. centrally controlling a plurality of machines, e.g. direct or distributed numerical control [DNC], flexible manufacturing systems [FMS], integrated manufacturing systems [IMS], computer integrated manufacturing [CIM]
H01L31/00	Semiconductor devices sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation and adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof; Details thereof
H01L31/04 H01L31/042 H01L31/18	adapted as photovoltaic [PV] conversion devices PV modules or arrays of single PV cells Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof
H02J7/00	Circuit arrangements for charging or depolarising batteries or for supplying loads from batteries
H05B6/00 H05B6/02	Heating by electric, magnetic, or electromagnetic fields Induction heating
Y02A40/00 Y02A40/80 Y02A40/81	Adaptation technologies in agriculture, forestry, livestock or agroalimentary production in fisheries management Aquaculture, i.e. culture of aquatic animals
Y02D70/00	Techniques for reducing energy consumption in wireless communication networks
Y02E10/00 Y02E10/40 Y02E10/44 Y02E10/50	Energy generation through renewable energy sources Solar thermal energy Heat exchange systems Photovoltaic [PV] energy
Y02E30/00 Y02E30/30 Y02E30/40	Energy generation of nuclear origin Nuclear fission reactors Other aspects relating to nuclear fission

Y02P60/00	Technologies relating to agriculture, livestock or agroalimentary industries
Y02P60/80	Food processing
Y02P60/87	Re-use of by-products of food processing for fodder production
Y02P60/877	from by-products of vegetal origin
Y02P70/00	Climate change mitigation technologies in the production process for final industrial or consumer products
Y02P70/50	Manufacturing or production processes characterised by the final manufactured produce
Y02P70/52	Manufacturing of products or systems for producing renewable energy
Y02P70/521	Photovoltaic generators
Y02T10/00	Road transport of goods or passengers
Y02T10/60	Other road transportation technologies with climate change mitigation effect
Y02T10/70	Energy storage for electromobility
Y02T10/7005	Batteries
Y02W10/00	Technologies for wastewater treatment
Y02W10/10	Biological treatment of water, waste water, or sewage
Y02W10/15	Aerobic processes