Journal of Intellectual Property Rights
Vol 30, September 2025, pp. 567-573
DOI: 10.56042/jipr.v30i5.10418

Fundamental Role of Intellectual Property in Developing Geoengineering Technologies for Climate Change Mitigation

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Received: 14th April 2024; revised: 28th April 2025

Climate change mitigation and adaptation require the intervention of climate engineering methods that remit climate change. One such engineering method involves geoengineering technologies, which can be defined as technologies that seek to modify the already existing natural climatic conditions. Geoengineering or climate engineering is a mechanism that has been developed to curtail the negative effects on the environment, it is a method operating with the use of scientific modifications and formulae that can be considered as environmental innovation ambitiously working to negate the climate change problems. Environmental innovations play a key role in climate change mitigation, and the development and diffusion of climate innovations or environmental innovations have a deliberate positive effect on the climate.

Geoengineering is a scientific modification or manipulation of the natural environmental systems that provides a possible solution to slow down and mitigate the effects of climate change. Intellectual property plays a substantial role in the research, development, and diffusion of geoengineering technologies. Patents for environmental inventions, such as geoengineering technologies, can be incremental in tackling the effects of climate change because they are new-age technologies promising to overcome the negative effects of climate change in the atmosphere.

Keywords: Geoengineering, Intellectual Property, Patents, Climate Change, Compulsory Licensing

Climate Change Mitigation Technologies- An Introduction

The International Panel on Climate Change (IPCC) defines 'Climate mitigation' as an intervention to reduce the sinks and sources of greenhouse gases. Mitigation broadly refers to plans, actions, and policies aiming to reduce the effects of climate change.

UNFCCC has played a significant role in facilitating the technology transfer among developed and developing countries. Article 4 of the Convention states that all parties must promote and cooperate in the development, application, and diffusion, including the transfer of technologies, that are intended to control and prevent anthropogenic emissions of GHGs. UNFCCC provides a clear definition of climate technologies as any technology used to address climate change, such as wind power, solar power, hydropower, etc.

The Kyoto Protocol agreement[1] promotes climate technology, stating that all parties shall cooperate in promoting effective modalities for the development, application, and diffusion of EST, and take all steps to promote, facilitate, and finance EST, particularly for developing countries.

The Paris Agreement[2] includes context about Climate Engineering, and the agreement contributes to a structured framework for climate change mitigation.

The Paris Agreement has demonstrated a strong interest in CATM measures[3]. Although these terms are not explicitly mentioned, the overall climate policy indicates that the ambitious target of limiting the global average temperature to below 2 degrees Celsius facilitates the application of scientific methods.

Climate Altering Technologies Measures (CATM) refers to climate engineering or geoengineering, which deliberately alters the natural climatic settings to alleviate the impacts of climate change[4].

Geoengineering is a main component of the Climate Altering Technologies Measures. The broad geoengineering methods SRM and CDR fall within CATM measures[5] these are scientific methods requiring high expertise and mechanisms to deal with the risks and uncertainties related to CATM Measures.

Geoengineering serves as a technical and scientific solution to environmental problems, coupled with experiments. It is beyond logic to navigate the effects of climate change through scientific modifications of the natural atmosphere.[6] CATM techniques, including

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CDR and SRM methods, have been broadly discussed at UNFCCC and the Paris Agreement; these international instruments have spurred interest in geoengineering climate policies in the world.[7]

Geoengineering for Climate Change

Geoengineering is described as the manipulation of certain specific processes that are central to the Earth's core as a method for offsetting climate change. The term geoengineering is also sometimes associated with the term 'climate engineering', which means a large-scale manipulation of the environment to reduce the unwanted negative effects of climate change.[8]

Geoengineering has been associated with two broad categories within the climate sphere: solar radiation management (SRM) or solar engineering, and carbon geoengineering or carbon dioxide removal (CDR).[9] The solar radiation management system, or solar engineering, is pushing the sun's radiation back into the atmosphere to offset human-caused climate change.[10] The approach of solar engineering is to cool the Earth's temperature by reflecting radiation into space. This process is also called solar radiation management.[11]

Carbon geoengineering, on the other hand, removes carbon dioxide from the atmosphere and aims to eliminate the problem of climate change, as it is the total removal of carbon dioxide from the environment.[12] Carbon engineering involves methodologies such as direct air capture, carbon capture storage, ecosystem restoration, blue carbon, ocean fertilization, and enhanced weathering.[13] Carbon geoengineering tends to reverse the carbon effects and impacts of carbon concentrations. The direct air capture technique compresses carbon dioxide into liquid, stores it, and uses it in carbon-neutral fuels or products.[14]

Legal Aspects of Geoengineering Technologies

The United Nations Framework Convention on Climate Change proposes broad modifications and the adoption of policies on Climate change mitigation.

(i) IPCC's First Synthesis Report also briefly discusses the CCS and CDR methods as part of geoengineering methods. CDR and CCS technologies have been defined by the report as these methods might reduce atmospheric greenhouse gas emissions, but there are certain biochemical and societal limitations.[15] However, if deployed properly, these methods can significantly reduce greenhouse gas emissions.

(ii) The current legal framework for geoengineering technologies is contained in the decision adopted by the Conference of the Parties to the Convention on Biological Diversity[16] in its ninth meeting relating to the use of geoengineering technology. This was the first international measure that dealt with geoengineering in the context of ocean fertilisation. At the tenth meeting, geoengineering was generally considered by the Conference of the Parties and related to a section on climate-related geoengineering.

(iii) The Conference on Biological Diversity, the tenth meeting, stated that considering the need for scientific, transparent, control, and regulatory mechanisms, gaps in geoengineering must be addressed.

(iv) The Convention on the Prohibition of Military or any other hostile use of Environmental Modification Techniques (ENMOD)[17] specifically mentions environmental modification techniques (Article 2) but promotes them only for peaceful purposes (Article 3). Novel techniques used in geoengineering technologies can deal with climate crises. The use of geoengineering techniques to combat climate change has been adopted ambitiously by the European Green Deal.

(v) The US Weather Modification Act mentions weather modification and states that potential and practical methods of weather modification must be established. It encourages the practical use of weather modification techniques for drought prevention, alleviation, and public welfare.

(vi) The Department of Science and Technology launched an R&D project in India, which was called the Major R&D project, MRDP. To undertake climate modelling experiments to generate more strategic knowledge about geoengineering. Deliberations have been held regarding geoengineering as a promising solution to climate change; however, no official policy exists on this matter.

Ethical Challenges of Geoengineering

The Climate Overshoot Report[18] states that geoengineering is a risky and controversial method with uncertainties. These costly methods require thorough examination, and the desired results are unpredictable.[19] Geoengineering is considered harmful for the agriculture and food sector on one end because

climate groups assert that when the action takes place, the heavy chemicals used in the methods are released into the air, causing even more disastrous situations, so geoengineering techniques appear to be a short-term solution, sometimes causing more damage than they mitigate.[20]

UNESCO has launched its latest report on climate engineering, which highlights the warnings and risks related to climate engineering. UNESCO's World Commission published this report on Scientific Knowledge and Technology, and it is the first report on climate engineering. The report states[21] that countries must take care of the impacts of their climate engineering actions, the research on climate engineering must be made on ethical and legal considerations, states have a responsibility to prevent any harm, are responsible for collaboration and research, and must introduce legislation to take care of all forms of geoengineering techniques.

Patents for Geoengineering Technology

Intellectual property is regarded as a 'scheme of governance,' pivotal for incentivizing innovations. Geoengineering technologies can be classified as environmental innovations crucial in promoting environmental preservation and broadening the scope of ecological developments.

Recognition of geoengineering technologies through intellectual property gives climate technologies a global pedestal, attracts revenues and investment, and promotes R&D and collaborations with foreign investors. A feasible way to acknowledge the geoengineering technologies through intellectual property is by patents.[22]

Patents are an important domain of intellectual property that are indicators of innovation, exclusive rights granted to creators of an invention that fulfils the criteria of being novel, having industrial applicability, and purporting to have an inventive step in the invention. Geoengineering technologies are not typical technologies, and thus their governance becomes difficult.

Geoengineering appears to be a new field, and its knowledge and awareness are still in their initial stages. For a patent to be granted, the areas for the invention must be clearly defined; however, regarding geoengineering patents, the areas are still cluttered.

Patenting geoengineering is developmental because it will foster a stronger scientific temperament. This has been considered the major driving force for attributing rights to inventors, as it increases the competitive advantage.[23] However, exclusivity also raises major concerns, such as the price of the invention becoming high, making it unavailable or inaccessible to society. Considering the infancy of geoengineering technologies, patents would restrict access to these technologies.

Granting patents on geoengineering technologies effectively grants patents on environment-related inventions, including green patents.

There are many more similarities because both these categories of environment-related inventions lack clarity or specificity; however, each of them has a significant role in tackling environmental-related challenges. Geographic differences are related to the different patenting behaviours of the countries, the differences in the developed and developing countries toward patenting frameworks, determining novelty could be a concern, lack of scientific expert knowledge during the examination of the geoengineering patent applications, in the geoengineering technology patent applications broad patent language is used and poorly defined that mostly results in holding most of the patent grants in one hand and only a few owners dictating the development of this field. This stifles innovation and the development of technology that has immeasurable potential to propose solutions for climate change. Geoengineering or climate engineering has the immense potential to revolutionise the environmental technology spectrum. It can significantly boost environmental innovations, provided they are more streamlined.

Today, patents are granted either as an SRM technology, CCS or CDR technology (broad language) and should be more refined. Patent schemes allow the inventors the exclusive use of the inventions, to maximize the grants for such technologies there can be instances of obscuring the related information of the geoengineering inventions, as mentioned above there is a problem with obtaining patents on broad languages which are known as 'patent land grabs,' blocking of patents' 'patent thickets' which are considered as unsuitable practices for the patent structure. Building blocking of patents is simply preventing the use, making and sale of an invention as it infringes the patents. Patent thickets refer to the web of patent rights owned by several inventors; this is an overlapping of patent rights that occurs when there is a complex technology involved.

Multiple inventors own patent rights for components used for creating the technology (in geoengineering technology, SRM and CDR can be the components).[24] This restricts innovation because inventors may not create similar inventions, as it involves patent rights on technologies with a similar nature and functions. This opens the way for licensing the inventions to maximise the use of the technology.

Patents on geoengineering technologies require an inclusion for environmental innovations, which could include these technologies broadly. A robust patent regime for such innovations is pertinent to recognizing the fundamental role of intellectual property in geoengineering technologies.

Utility Model Patents can be a beneficial model design for the development of environmental innovations. They can be classified as 'incremental innovations', so that protection for such technologies can be given for a shorter duration, by easing out the stringent regulations present in the patent protection system. The utility model system offers protection at comparably less stringent rules for examination processes and also is less expensive than patent protection, however, every country implementing the utility model system has its own set of rules, and this model can be suitable for inventions intended to have a short term life cycle with certain objectives in that case instead of waiting for the grant of a patent, this model can be conveniently used to serve the purpose for which the invention was made. Utility model systems are present in many developed and developing countries to promote an innovation ecosystem.

Compulsory Licensing of Geoengineering Patents

In this section, the implications of compulsory licensing for geoengineering patents are discussed. Compulsory licensing is defined as the government's authorization to use a particular invention if that invention has not been made available to the public for a reasonable period and at a reasonable price.

International Law on Compulsory Licensing

The provisions for compulsory licensing have been defined under Article 31 of the TRIPS agreement,[25] which states that other uses are prohibited without the authorization of the right holder. The agreement does not explicitly mention the term compulsory licensing; however, it mentions a few exceptions where it allows the government or a third party to use an invention without authorization from the patent holder. The provisions under which such use is allowed are that such authorization has to be made allowed on individual merits, prior efforts have been made to obtain authorization from the owner on 'reasonable commercial terms' for a reasonable period, and such efforts have not been successful. However, this provision can be waived if there is a national emergency, other cases of extreme urgency, or public non-commercial use. However, the scope and extent of national emergencies or cases of extreme urgency have not been specified. Other provisions of the article state that such use shall be non-exclusive, such use must be non-assignable, etc.

Domestic Law on Compulsory Licensing

The general notion of patent law in India is that patents are granted for the public good; hence, a patentee shall not misuse or exercise any monopoly granted by a patent. The provisions for compulsory licensing have been clearly defined in sections 84 to 94 of the Patents Act of 1970. Section 84 of the Indian Patent Act[26] specifically addresses the grounds on which compulsory licensing can be allowed.

(i) Compulsory licensing because a reasonable requirement of the public has not been satisfied. The requirement is that the invention be made available to the public.
(ii) Compulsory licensing because the patented invention was not available to the public at a reasonable price. This provision states that the invention must be affordable so that the public can afford and use it if it is made for the public.
(iii) The patented invention has not worked in the territory of India. This provision means that working in India means that the invention must be manufactured in India.

The application for the grant of compulsory licensing must be made before the Controller General by any interested person after the expiration of three years from the grant of a patent on the invention. The Controller General of India has been given the authority to consider the grounds and grant the compulsory license if he deems fit. Suppose the controller is satisfied that the terms, conditions, and restrictions imposed by the patentee have been unreasonable and contrary to the scope of the act and that the patentee's conditions have hindered the manufacture, use, and sale of the invention. In that case, he may allow the grant of a compulsory license.[27]

Scope of Compulsory Licensing for Climate Change Mitigation Technologies

Compulsory licensing is a substantive and procedural provision usually considered tough to implement. The US Supreme Court stated that granting compulsory licensing is a rarity and is a last resort, given the stiffness of the compulsory licensing provisions.[28] It is generally not adopted unless the applicants fulfil the set criteria.[29]

There is a dichotomy regarding exercising compulsory licensing because it can help provide access to technologies where there was a need for them, and they were not disseminated properly due to strict patent provisions. In contrast, it is critical to the commercial value of the invention. Compulsory licensing can be allowed because it makes an invention accessible to the public. Compulsory licensing, therefore, is a powerful way to gain access to geoengineering or climate engineering.[30] However, there must be limited use of the provisions of compulsory licensing that require a structured framework to deal with geoengineering or climate engineering.

The number of patent filings in the country and the grant of such patent applications have raised concerns about the number of patents held by the patentees. If a patent that has its basis for climate change mitigation does not reach society, then the purpose of the invention as a 'climate engineering solution' raises a concern. Mostly, the climate engineering activities that have ecological benefits are taken by private entities, who retain possession of these technologies, making it next to impossible for the public to know about the climate engineering benefits. Usually, the larger public remains aloof due to such technologies because of the patent rights that become detrimental to the technologies as well, as they become concentrated only in the hands of a few private players. The protection is strong and results in restricted use, which directly affects the diffusion of such technologies. It might also affect the maximised use of climate engineering.

Climate engineering technologies, also known as geoengineering technologies, differ due to their unique utility in addressing climate change.[31] They are 'pro-ecological mechanisms' to combat and mitigate environmental concerns. Compulsory licensing can become a potent way to acknowledge the full potential of geoengineering technologies and for the widespread diffusion of geoengineering technologies. Obstructions or restrictions are eliminated; compulsory licensing is also helpful in accelerating domestic intellectual property by getting access to some foreign-developed technologies.

Climate mitigation technologies, such as geoengineering and green technology, play a significant role in sustainability, necessitating the adaptation of structured accessibility. Therefore, intellectual property strategies such as cross-licensing and patent pooling by new enterprises working in the field of environmental technology can be an effective way for disseminating such technologies it will also facilitate knowledge and know-how among different partners, and can be efficacious for several enterprises to benefit from each other's technologies.[32] Open licensing procedures can be an effective mechanism for enabling, promoting and diffusing such technologies.

Conclusion

Climate change is not a territorial or jurisdictional problem it is beyond that, so the patents on geoengineering or any similar climate change mitigation technology must not be restricted jurisdictionally rather single invention filed and published in multiple patent offices, offering a degree of control for patent quality by representing inventions which the inventor seeks protection internationally must be put into international patent families (IPF), it can be a reliable tool for the comparison of the innovative activities of countries through patent families. To solve the problem of 'patent thickets,' especially international patent families can be introduced to measure the inventive activity also providing a degree of control over the quality of the patents.

It is imperative to bring necessary reforms in the existing patent regime through incentive measures for climate and environment-friendly technologies. The practice of incentivization may include the provision of an extension of the validity period of a green patent, reduction of annual fees, and fast-tracking of the patent examination process. Considering the efficiency of the existing patent pooling model, compulsory patent pooling practice about environmentally sound technologies (EST) can be an effective model if introduced with proper regulatory mechanisms.

A sui generis utility model system can also be adopted in India, similar to developed and developing

countries, specifically for climate and environment-friendly innovative technologies that protect incremental innovations. This will help domestic innovators in India develop their inventions, creating a space for a competitive market. At the same time, it is important to oversee and identify junk patents due to the rising number of patent filings.

Given the severity of climate change as a glaring issue, various approaches have been adopted at the global and domestic levels however there is still a polarity regarding the development and deployment of geoengineering, as there are no specific rules or policies that govern geoengineering as a practice moreover, whether they deal with geoengineering in general or a specific part that is also unclear, there are possible risks of undertaking the geoengineering projects such as the responsibility claims like how and when the climate engineering or geoengineering projects should be undertaken, how the consequences to be measured in case if the experiments do not lead to desired results, the jurisdictional claims also have to be determined to overcome this gap.

The Ministry of Environment, Forests and Climate Change (MoEFCC), India, must establish a policy for the IPR regime in environmental innovations. This policy would facilitate the development of effective mechanisms, from the initial stages of geoengineering to the experiment's outcome, and ensure proper R&D before undertaking any geoengineering project.

Such policies will strengthen the strong IP protection recommended for geoengineering technologies, which will help incentivise these technologies and attract foreign expenditure, which would be beneficial for the domestic market. There is a dire need to develop a detailed, effective, and strict policy for the governance of geoengineering that is in line with the legal statutes.

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