Journal of Intellectual Property Rights
Vol 23, Jan 2018, pp 27-34

Climate Change and Technology Transfer: Tying the Knot through Human Rights

Uday Shankar, Tapas K Bandopadhaya and Chandrika Mehta[†]

Indian Institute of Technology Kharagur, Kharagpur, West Bengal 721 302, India

Received 5 March 2018; accepted 3 May 2018

Mindless exploitation of nature has caused immense damage to human environment. Human activity through technological interventions has contributed to global warming. The incremental rise of temperature has not only threatened the life of individual but also questioned the role of technology in bringing the development. Climate change has thrown a challenge on the scientists/inventors to commit to environment-friendly technology. Realizing the potential damage from climate change, the government world-over, primarily from the developed economy, started investing upon climate friendly technology. Clean energy technology is made subject to a variety of intellectual property protections. Consequently, the exclusive usage of the technology remained with the developed economy leaving behind three-fourth of humanity to deal with the challenges of climate change on their own. Nature knows no boundaries, thus, the effort to mitigate adverse impact upon should not be mortgaged to rich and resourceful. The obligation to employ environment friendly technologies should be made non-negotiable and to be made available from North to South. However, the rigour regime to protect intellectual property brings in challenge for developing nations to import and deploy the green technology for development activities. Comity of Nations has accepted the fact of global warming, natural as well as anthropogenic. The United Nations Convention on Framework Convention on Climate Change bears the testimony of the commitment of the international community to combat the "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Proponents of IP present a facilitative IP regime as a condition precedent to innovate and develop new clean energy technologies. Whereas opponents of IP finds, the exclusion rights to patent holders as a bottleneck to access the technology. Climate change poses significant threat to the rights to life, adequate food, water, health, adequate housing, and self-determination, while also highlighting the particular impacts on highly vulnerable groups such as women, children, and indigenous peoples (OHCHR, 2009). The issue of access to the technology to contain greenhouse emissions should be seen through the prism of human rights in order to obligate state to address climate change crisis.

Keywords: International Council on Human Rights Policy Report, Climate Change, Human Rights, World Health Organization, Convention on the Rights of the Child, Green House Gases, The Convention on the Elimination of Discrimination against Women

Nature permits human intervention to fulfill developmental and nutritional need of mankind. Human interventions are needed for better and comfortable living. A better living requires technological advancement in every field. An advance technology needed to produce enough food, adequate housing, better health services, and other public services. These needs are fundamental and indispensable for dignified life. Thus, no government can afford to overlook the need and the means to fulfill the same. The mechanism to fulfill these basic needs may differ from country to country depending upon technological strength. In the process of achieving faster growth, countries are unmindful about the exploitation of natural resources which has been causing irreparable damage to environment. One such adverse effect is seen in the form of climate change.

Climate change is a complex problem which the world is confronting today. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.[1] Climate change is threatening the human civilization of serious repercussions.

The threat to human life has compelled the global leaders to address the problem on urgent basis. The problem is not territory specific, thus it requires comprehensive perspective in meeting challenge arising from global warming. Technology transfer from industrially advanced countries to developing and least developing countries is projected as a

[†]Corresponding author: Email: chandrikamehta93@gmail.com

sustainable solution to the problem. But, the issue of technology transfer is looked upon from the perspective of trade between developed and developing countries. This approach discourages the developing and least developed countries to engage with the developed countries due to uneven terms imposed by the later on the former. The developing and least developed countries are compelled to employ polluted technology which contributes in the emission of green-house gases.

This paper presents an alternative narrative on issue of climate change and technology transfer from a perspective of human rights. The global warming is threatening the enjoyment of rights, thus there is a need to look at the issue of technology transfer from the human rights perspective where the developed countries will be obligated to commit to the cause of climate change. In the beginning, the paper builds a connection between climate change and human rights. Further, it examines the issue of technology transfer from the perspective of human rights law, particularly, international cooperation as envisaged in the various international human rights law. In conclusion, it tries to settle the debate that the climate change and technology transfer need to viewed from human rights perspective for sustainable solution of the problem.

Climate Change and Human Rights: Drawing the Relationship

Climate change refers to the variation in the climate of the earth, global or regional. It describes changes in the state of the atmosphere over time scales ranging from decades to millions of years. There is no unanimous definitional understanding of the term "climate change". Climate change has been defined by many in many ways. While some define it as an offshoot of Earth's natural processes, others define it as a result of human activities. Striking a balance between these two varying perspectives, climate change is defined as "a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".[2] Human activity is contributing in unabated emission in green-house gases which has been seen in the form of floods and cyclones. These have resulted into destruction of crops, property and infrastructure, as well as in negative impacts on human health and well-being.

The relationship between climate change and human rights was laid out in some detail in the 2008 International Council on Human Rights Policy Report *Climate Change and Human Rights: A Rough Guide* (Rough Guide). The report noted that "as a matter of simple fact, climate change is already undermining the realization of a broad range of internationally protected human rights: rights to health and even life; rights to food, water, shelter and property; rights associated with livelihood and culture; with migration and resettlement; and with personal security in the event of conflict".[3] The ICHRP records a range of predictions from leading sources in two annexes, which strongly support the claim that climate change-induced harms will cause vastly increased hunger, water-stress, losses of livelihoods and dwellings, and in some extreme cases, loss of the entire territorial base of certain states.[4]

Human rights are enjoyed by human being for the fact of 'being'. They are inseparable, inviolable and universal in nature. Initially, they were viewed as a potential instrument to limit the power of the state. Now, they are emerging as an important instrument to regulate the conduct of non-state actors. They are weapon in the hand of weaker to correct the distorting effects of power. Human rights aim fundamentally to counteract power imbalance. In this perspective, the linkage between climate change and human rights can be developed. If the activities of powerful pose existential threat to the 'life' of individual, then such activities cannot be seen as some odd activities connected with some individual or non-state actors.[5]

The impact of climate change has adverse impact on various rights guaranteed by the Constitution. The section broadly constructs the argument with the help of the right to access to energy, health and food. It only portrays the indicative picture of the possibility of linkage between climate change and human rights.

Article 21 of the Constitution guarantees the right to life to every person. The celebrated provision has been given very expansive meaning and content through various judicial pronouncements. The Court has explained that the fundamental right does not only refrain the state from intervening with the enjoyment but also imposes obligation on the state to make the 'life' meaningful and worthy for every individual.[6] The preservation of 'life' is of vital importance, because if one's life is lost, the *status quo ante* cannot be restored as resurrection is beyond capacity of man.[7] The ever-growing concern of global warning

presents a visible challenge to the enjoyment of 'the right to life'. The damage to environment due to climate change would cause irreparable loss to life, thus it is to be looked from the perspective of human rights. If you read the concern of climate change under the narrative of human rights, then the expansive reading of 'life' may provide a solution in 'right' framework.

Access to energy is a vital requirement for the enjoyment of 'the right to life'. Energy is essential to satisfy basic human needs and to achieve the goals of social welfare and prosperity.[8] The rapid global economic development has been possible in the 20th century because of the supply of energy.[8] Energy plays a vital role in realizing the "basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency and intensive care), educational aids, communication (radio, television, electronic mail, the World Wide Web),and transport".[9] Energy is important to put life into other human rights and making them meaningful for all people irrespective of their societal status.[10] The need of energy is integral to several sectors such as, infrastructure, health services and education. The International Energy Association projects India's primary energy demand to more than double by 2030 which is attributable to ambitious growth rate for attaining economic and human development. In this scenario, India will become the world's third-largest carbon dioxide emitter by 2030, although per-capita emissions will still be comparatively low. India's current electrical system runs mostly on domestic coal: 82.7 percent fossil fuel, 14.5 percent hydropower, and 3.4 percent nuclear. India has made promising commitment at the global platform of boosting the production of energy through green sources so that she can effectively participate in mitigating the challenge of climate change. But, the success of the commitment not only depends upon political will but also availability of technology with the industry to contribute in greener way.

One on hand access to energy is instrumental in enjoyment of several fundamental rights, on the other hand the resources required to generate electricity is not based on clean technology. It presents a difficult situation for the government in designing a policy to give realisation of the rights by keeping the promise of clean energy. The promise to ensure access to energy need to be seen in the context of climate change issues, both mitigation and adaptation. The use of conventional source of energy and its impact on global warming is doing no good to the cause of human rights.

Climate change poses a host of threats to the survival of mankind. The debilitating impact of climate change has broadened the sphere of discourse much beyond the traditional concern like environment or development. The far reaching consequences of climate change have forced policymakers and planners to look at every possible aspect of human survival. Arguably, it has catastrophic effects on human health. Each year, about 800,000 people die from causes attributable to air pollution, 1.8 million from diarrhoea resulting from lack of access to clean water supply, sanitation, and poor hygiene, 3.5 million from malnutrition and approximately 60,000 in natural disasters. A warmer and more variable climate would result in higher levels of some air pollutants, increased transmission of diseases through unclean water and through contaminated food.

Anthropogenic climate change is most likely to have serious adverse impacts on the lives of people and nations. The advent of global environmental change is ripped with uncertainties looming large over mankind.[11] Almost all the impacts of climate change have direct or indirect consequences for human health.[12] For example, a positive relationship has been observed between regional trends in climate (rising temperatures and declining rainfall) and childhood stunting in Kenya since 1975, indicating that as projected warming and drying continue to occur along with population growth, food yields and nutritional health will be impaired.[13] A large number of studies present evidence for the effects of observed climate change on vector borne and other infectious diseases.[14] There are several mechanisms by which climate can affect health.[15] Extremes of temperature and rainfall, such as heat waves, floods and drought, have direct immediate effects on mortality as well as longer term effects.[14] Climate change is also likely to affect biodiversity and the ecosystem goods and services that we rely on for human health.

Climate change has a direct impact on human health. For example, the warmer the climate the likelihood of its impact on human health becomes worse. Available studies suggest that there will be an increase in health problems. It is anticipated that there will be an increase in the number of deaths due to greater frequency and severity of heat waves and

other extreme weather events Climate change is a major factor in the spread of infectious diseases. Diseases, confined to one specific geographic region spread to other areas.

The World Health Organization (WHO) in their studies have indicated that due to rising temperatures, malaria cases are now being reported for the first time from countries like Nepal and Bhutan. It has also been predicted that an additional 220-400 million people could be exposed to malaria- a disease that claims around 1 million lives annually. Dengue fever is already in evidence at higher levels of elevation in Latin America and parts of East Asia. Climate change could further expand the reach of the disease. Studies suggest that climate change may swell the population at risk of malaria in Africa by 90 million by 2030, and the global population at risk of dengue by 2 billion by 2080s. Rising temperatures and changing patterns of rainfall are projected to decrease crop yields in many developing countries, stressing food supplies. This will ultimately translate into wider prevalence of malnutrition/ under nutrition. In some African countries, yields from rain-fed agriculture could be reduced by up to 50 per cent by 2020.

Emission of the green house gases has been responsible for the depletion of ozone layer, which protects the Earth from the harmful direct rays of the sun. Depletion of stratospheric ozone results in higher exposure to the ultra violet rays of the sun, leading to an increase in the incidents of skin cancer. It could also lead to an increase in the number of people suffering from eye diseases such as cataract. It is also thought to cause suppression of the immune system. The projections by WHO and IPCC suggest that the negative effects of climate change on health are greater. In addition, the negative effects are concentrated on poor populations that already have compromised health prospects, thus widening the inequality gap between the most and the least privileged. The balance of positive and negative health impacts will vary from one location to another, and will alter over time as temperatures continue to rise.

The Covenant on Economic, Social and Cultural Rights (ICESCR) recognizes the "right of everyone to enjoy the highest attainable standard of physical and mental health".[16] The right to health is also referred to in a number of Articles in the Convention on the Rights of the Child (CRC). Article 24 of CRC stipulates that State parties must ensure that every child enjoys the 'highest attainable standard of health'. It lays emphasis on the right of every child to have access to facilities for the treatment of illness and rehabilitation of health. Article 12 of The Convention on the Elimination of Discrimination against Women contains similar provisions. Article 12 of the CEDAW states

(1) 'States parties shall take all appropriate measures to eliminate discrimination against women in the field of health care in order to ensure, on a basis of equality of men and women, access to health care services, including those related to family planning.'

(2) Notwithstanding the provisions of paragraph I of this article, States Parties shall ensure to women appropriate services in connection with pregnancy, confinement and the post-natal period, granting free services where necessary, as well as adequate nutrition during pregnancy and lactation

Climate change is also threatening food security. The vulnerability of the right is visible with growing sea-level and rise in the temperature. Dynamic interactions between the non-anthropogenic and anthropogenic elements lead to the production, processing, distribution, preparation and consumption of food resulting in food systems that underpin food security.

In one of its report, the *Intergovernmental Panel on Climate Change* (IPCC) observed, "warming of the climate system is unequivocal, as is now evident from observation of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." The average number of weather related-disasters has increased six-fold in recent decades - from 120 per year in the 1980s to 500 per year currently.

The drastically changing contours of climate have revived the most widespread fear of food insecurity. Irrespective of the cause of climate change, it has the potential to pose serious implications on social and economic disruptions across the globe. Agriculture has been identified as a vulnerable sector owing to its dependence on environmental resources and weather conditions. This in turn poses serious food security concerns for the world.

There are supposedly two ways to look at this issue. The first outlook is essentially pro agriculture. The impact of climate change on agriculture forms the basic premise of study in the first case. Climate change threatens to wreak havoc on food production by increasing the frequency and severity of extreme

weather events, depressing agricultural yields, reducing the productivity of the world's fisheries, and placing additional pressure on scarce water resources. Climate change will result in uneven rainfall distribution and thereby create conditions for crop production with obvious implications for food security. Global climate change is likely to weigh on the agricultural systems thereby resulting in a demand–supply crisis. The effects of climate change will be felt more heavily by the most vulnerable section of the society devoid of technological advancements.

According to the IPCC, yields for rain fed farming could decrease by as much as 50% in large areas of Africa by 2020 as the climate becomes hotter and drier. By 2080, agricultural output could decline by as much as 28% in Africa, 24% in Latin America, and 19% in Asia. Agricultural output in India could decline by as much as 38% and some African countries could experience declines in excess of 50%. Consequently, climate change is also projected to severely effect biodiversity by causing the significant extinction of species and the loss of ecosystem services essential to food production.

Mankind is in dire need of alternate agricultural development paradigms that would encourage more ecologically, biodiverse, resilient, sustainable and socially just forms of agriculture. The basis for such new systems are the myriad of ecologically based agricultural styles developed by at least 75% of the 1,5 billion smallholders, family farmers and indigenous people on 350 million small farms which account for no less than 50% of the global agricultural output for domestic consumption .

The second outlook presents a scenario wherein industrial agriculture is said to pose serious threats to the environment and contributes to the ill effects of climate change. Agriculture is responsible for approximately 13.5% of Global Greenhouse Gas (GHG) emissions, primarily methane and nitrous oxide. The rapid expansion of industrial agriculture has produced an unprecedented loss of plant genetic diversity making the world's food supply dangerously vulnerable to wide-spread crop failure. Industrial agriculture makes extensive use of nitrogen fertilizers and synthetic pesticides which are considered as one of the largest source of GHG emissions.

Climate Change and Technology Transfer: Human Rights Tying the Knot

Technology Transfer is seen as possible solution to meet the challenges which climate change is posing to the world. The urge to lead better and dignified life should not depend upon acquisition of cleaner technology by least developed or developing countries. They commit to undertake all possible steps required for guaranteeing meaningful life to their citizens. Economic development is considered as a significant process to achieve better living but the cause of environment takes a back seat. The environmental degradation caused due to unplanned developmental activities can be effectively addressed through technology transfer mechanism. The mechanism of technology transfer is not to be viewed only from commercial perspective but also from a potential tool to realize the human rights.

Technology transfer is the process by which a technology, expertise, know-how or facilities developed by one individual, enterprise or organization is transferred to another individual, enterprise or organization. The Intergovernmental Panel on Climate Change (IPCC) defines technology transfer "as a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions.[17] Technology transfer may happen from country to country, from industry to industry or from research laboratory to an existing or new business. It may be facilitated by financial or other types of assistance and support that may be provided by government or other agencies at national, regional, local or institutional levels technology transfer has three very significant dimensions to it-economic development, enhancing social welfare and environmental soundness. Ideally, technical cooperation should contribute positively to all three dimensions. The transfer and diffusion of technology are crucial to building their domestic technological capabilities; and the role of Governments in supporting this process, as well as in building on it to develop and enhance national innovations systems (NIS), is fundamental.[18] The legal relationship between transferor and transferee is essentially contractual in nature, which means that the transferor of the technology consents to transfer and the transferee consents to acquire the rights, the permission or the know-how in question. There are various methods and

legal arrangements through which technology may be transferred or acquired, being through sale or assignment of IP rights, MOUs, License contracts, know-how contracts, joint ventures, turnkey projects, FDIs and research collaborations.

The international political response to climate change began at the Rio Earth Summit in 1992, where the 'Rio Convention' included the adoption of the United Nations Framework Convention on Climate Change (UNFCCC). This convention set out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases (GHGs) to avoid "dangerous anthropogenic interference with the climate system." the UNFCCC has 195 countries enlisted as its members.

Technology facilitation mechanism can be seen to play an important role in climate mitigation and adaptation process. The draft text of the recently concluded COP21 in Article 7 mandates cooperative action on technology development and transfer through improving endogenous capacities and enabling environments and specifically addressing, recognizing and overcoming the barriers to the transfer of safe, appropriate and environmentally and socially sound technologies.[19]

Currently there are major inequalities among countries in accessing technologies and finance. In most cases, the developing nations are yet to acquire the right kind of technologies and assistance in terms of development and facilitation. Access to existing technologies and technological innovations is commonly seen as a prerequisite for the reduction of emissions in developing countries.[20] There has to be effective channels to enable successful transfer of technology. The origin of transferring sustainable energy technologies in the context of the international climate co-operation and in particular from industrialized countries to developing countries lies in Article 4.5 of the United Nations Framework Convention on Climate Change. In 1997, Agreement of the Kyoto Protocol placed the burden of reducing carbon emissions on the developed and transitioning countries responsible for the initial increase in carbon concentrations. Together the UNFCCC and the KP have been major catalysts for incentivizing and financing technology transfer and investments into low carbon technology in developing countries.

In the context of technology transfer Article 8.2 of TRIPS is important as it acknowledges the necessity to prevent the resort to practices that adversely affect the international transfer of technology and at the same time has a rider, that the measures should be consistent with the provisions of TRIPS. Induction of low carbon, energy efficient green technologies pose a number of challenges. Access to existing technologies and technological innovations is commonly seen as a prerequisite for the reduction of emissions in developing countries.[20] The absence of reliable access to clean energy and the services it provides imposes a large disease burden on low-income populations and impedes prospects for development.[21] Efficient technology cooperation is a means to accessing viable low carbon and energy efficient technologies.[22] The key challenge in this respect is that low-carbon sustainable technologies need to be adopted both by developed as well as developing countries, which requires that developing countries avoid past unsustainable practices and being locked into old, less sustainable technologies. Researchers have examined and understood the barriers to technology transfer. Mostly, these barriers affect developing nations' capacity to innovate and also prevent it from gaining access to such technologies. Import of technologies by the recipient country can prove to be a costly affair. Thus the transfer may be affected by a lack of investment owing to poor financial mechanisms.[20] Frequently, a lack of access to capital hinders technology recipients from getting an investment financed.[20] Political barriers can impair the transfer process as well. In the absence of strong environmental policies, low carbon technologies will face restraints in the name of policy decisions and regulations. Moreover, recipient countries can make effective use of the transferred technology only if the know-how is also transferred along with. Also, the recipient country must have resources to operate the transferred technology in the absence of geological barriers.

In addition to the exigencies of transfer and diffusion of low carbon technologies to nations alike, there is an ongoing debate among the proponents of intellectual property rights regime who emphasize the need of IPRs in encouraging innovation to green technologies on the one hand, and those who view intellectual property as barriers financially strapping developing countries from gaining access to such technologies.[23] Under the TRIPS Agreement, developing and developed countries have the right – under certain circumstances – to exercise their right to emit compulsory licenses for patents that has been

determined necessary for the country.[24] Nations that are not entirely capable of manufacturing green technologies can be benefitted if compulsory licensing for such technologies is accepted. Principally, technology transfer through compulsory licensing would speed up global green technology development by allowing companies in developing nations to begin innovating and improving on currently held patents without having to wait until the expiration of patent rights.[23] Article 31 of the TRIPS, allows certain flexibilities for governments to issue compulsory licenses, under certain circumstances after required criteria has been met.[24] Owing to lack of national capacities or fearing restraint and obstacles to foreign direct investments, governments may avoid imposing a compulsory license on green technologies. For major companies, the argument is based on IP rights violation and product cost issues.[25]

The effect of technology transfer on meeting the challenge of climate change is indisputable. The narrative of human rights can, arguably, provide for a better legitimacy to build a strong case of technology transfer to poorer nations from the rich one. It will create a new imperative of examining the issues beyond the market based standards.

Conclusion

Climate change is emerging as a big challenge to the mankind. It is threatening the human civilization. The enjoyment of human rights is under tremendous stress with the change in climatic condition of the earth. All the possible solution to resolve the challenge of climate change need to be examined from human rights perspectives. One such solution lies in technology. Human rights can provide effective means of focusing and prioritizing areas for climate change intervention. They provide a means that rests on a broadly accepted standard which would legitimize the priority of the vulnerable class for whom the right matters the most. The availability of resources should not become an obstacle to enjoy right or to negotiate with the enjoyment of qualitative aspect of right.

Climate change as a current global crisis poses unprecedented challenges owing to its multidimensional character as well the absence of ideological consensus[26] on policy implementation. The complexity of the challenges so posed as a result of climate change has undermined the idea that a nation state could claim to deal with the catastrophe on its own. Therefore, owing to its global impacts, climate change needs to be met with diverse local manifestations and calls for greater international cooperation.

This paper has drawn a number of connections between climate change and human rights in that technology has been said to play a vital role in the mitigation and adaptation of climate change. Transfer of technology as s strategic means of mitigating and adapting climate change can be a vital source for sustaining improvements in the quality of life of people across the globe. In all, the quality of life must be treated as a significant human right issue and steps in all modesty must be taken to ensure the people their basic and fundamental rights.

References

1 Climate Change 2007, Synthesis Report (A Report of the IPCC), p. 2.

2 Article 1, United Nations Framework Convention on Climate Change.

3 ICHRP, Climate Change and Human Rights: A Rough Guide, 2008, 1.

4 Humphreys S, Beyond technology transfer: Protecting human rights in a climate-constrained world, *The International Council on Human Rights Policy*, 2011.

5 Sinden A, Climate Change and Human Rights, *The Journal of Land, Resources & Environmental Law,* 27 (2) (2007) 255.

6 *Maneka Gandhi* v *Union of India*, AIR 1978 SC 597.

7 *Parmananda Katara* v *Union of India*, AIR 1989 SC 2039.

8 UN Report on World Energy Assessment, *An Introduction to Energy*, 2000, p. 31, http://stone.undp.org/undpweb/seed/wea/pdfs/chapter1. pdf.

9 UN Report on World Energy Assessment, *Energy and Social Issues*, 2000, 44, http://stone.undp.org/undpweb/seed/wea/pdfs/chapter2.pdf.

10 Shankar U & Sharma S, Access to Energy: Looking Through the Prism of Human Rights – Indian Experience, *The Journal of Energy and Environment*, 38 (1&2) (2013) 221.

11 Environmental Change, Climate and Health: Issues And Research Methods, (P Martens & A J McMichael eds., 2002).

12 Barata M *et al.*, *Climate change and human health in cities*, in Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network, (Cynthia Rosenzweig *et al.* eds., 2011), 179–214.

13 McMichael A J, Globalization, climate change, and human health, *New England Journal of Medicine*, 368 (14) (2013) 1335-1343.

14 Haines A, Kovats R S, Campbell-Lendrum D & Corvalán C, Climate change and human health: Impacts, vulnerability and public health, *Public Health*, 120 (7) (2006) 585-596.

15 Haines A & Patz J A, Health effects of climate change, *Jama*, 291(1) (2004) 99-103.

16 Article 12.1, ICESCR.

17 UNFCC, The contribution of the clean development mechanism under the Kyoto Protocol to technology transfer, 2010.

18 UNCTAD, Trade and Development Board, *Foreign Direct Investment, the Transfer and Diffusion of Technology, and Sustainable Development*, Geneva 2010.

19 Mabey N *et al.*, Judging the COP21 outcome and what's next for climate action (*E3G*, 18 January 2016) http://www.e3g.org/library/judging-cop21-outcome-and-whats-next-for-climate-action, (accessed on 28 January 2016).

20 Schneider M, Understanding the CDM's contribution to technology transfer, *Energy Policy*, 2008, 36, www.elsevier.com/locate/enpol, (accessed on 22 May 2015).

21 Haines A *et al.*, Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change, *Energy and Health*, 2007, 370, www.thelancet.com (accessed on 22 May 2015).

22 Shujing Q, The analysis on barriers of low carbon technology transfer, *Energy Procedia,* 2012, 14, www.sciencedirect.com, (accessed on 22 May 2015).

23 Gupta R, Compulsory Licensing in TRIPS: Chinese and Indian comparative advantage in the manufacture and exportation of green technologies, *Sustainable Development Law and Policy,* 2011, 12, http://heinonline.org, (accessed 22 May 2015).

24 Karlsson A, Green technology patents: TRIPS, Compulsory Licensing and Global Health, (Stockholm University 2014).

25 Awad B, Patent Pledges in green technology, Centre for International Governance Innovation, 2015, https:// www.cigionline.org/sites/default/files/no.81.pdf, (accessed on 22 May 2015).

26 Falk R A, Global Climate Change, Human Security and the Future of Democracy, in Stephen Gill (ed), *Global Crises and the Crisis of Global Leadership* (Cambridge University Press 2011).