

UK-INDIA COLLABORATION TO OVERCOME BARRIERS TO THE TRANSFER OF LOW CARBON ENERGY TECHNOLOGY: PHASE 2

Intellectual property rights and low carbon technology transfer to developing countries – a review of the evidence to date

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Scope of this report

This report supports the commencement of Phase II of the UK-India collaborative study on low carbon technology transfer. It provides a review of some of the literature on intellectual property rights (IPRs) in relation to low carbon technology transfer to developing countries and attempts to organise this in such a way as to highlight significant findings and provide a contextual basis upon which to proceed with further desk based and field research on this theme. Based on the findings of the Phase I UK-India study, I also set out an important consideration which, based on current understanding of the IPR debate, is central to informing whether or not IPRs might be considered as representing a barrier to low carbon technology transfer. This relates to the extent to which we are primarily concerned with rapid deployment of low carbon technologies for greenhouse gas mitigation or with the long term technological development of developing countries.

IPRs and low carbon technology transfer – the issue

Low carbon technology transfer is at the forefront of international climate negotiations. The promise of access to new technologies is widely recognised as a central incentive for developing nations coming on board in the United Nations Framework Convention on Climate Change (UNFCCC). Many nations have, however, been left feeling frustrated at the lack of progress that has been made in achieving technology transfer in practice. Negotiations on the issue have become increasingly fraught, with clean technology nearly falling off the agenda in Bali 2007 due to disagreements between the US and China/G77.

A central problem with all policy negotiations on low carbon technology transfer to developing countries is the lack of empirical evidence upon which to base policy design. Low carbon technologies are unique in terms of the early stage of development and deployment that many of them have reached and the speed at which they need to be deployed. They are therefore often subject to barriers to their transfer that are quite distinct from other technologies which have formed the bulk of past research on technology transfer. The lack of low carbon specific research in this area means that policy discussions are characterised more by intelligent assumptions rather than empirically based assertions. This is concerning at a time when multimillion dollar funds for low carbon technology transfer are being discussed and deployed.

One issue that has provoked particularly thorny debate between developed and developing countries is the issue of intellectual property rights (IPRs). There are essentially two aspects to concerns with IPRs in relation to technology transfer. The first is a concern with access to IPRs for new technologies, the second is a concern with the need to tighten up IPR protection via legislation and enforcement thereof in developing countries. I deal with each of these in turn below.

Drawing on assumed parallels with the pharmaceutical industry and access to, for example, anti-retroviral drugs, some observers claim that a lack of access to IPRs for new low carbon technologies is a key barrier to their transfer and deployment in developing countries. This could be insofar as IPRs prohibit access to new technologies in the first place by, for example, enabling firms that own patented technologies to keep prices prohibitively high. It could also reduce the scope for imitation which, in countries such as South Korea and Japan, and even the US, has been a key source of learning and technological change (ICTSD and

UNCTAD 2003, p.85). There is also a strong political aspect to this in that access to new technologies is seen by many as constituting the main “carrot” that attracted many developing countries into the UNFCCC and the Kyoto Protocol – a promise widely observed as not having been effectively delivered on.

Such arguments have led to calls within the UNFCCC negotiations for multilateral funds to be created to buy up IPRs for clean technologies and make them freely available to developing countries. Critics of such a fund, however, highlight the fact that access to a patent is unlikely to prove sufficient to enable access to that technology. There is often a lot of undisclosed tacit knowledge associated with patents that is essential to understanding and working with new technologies (ICTSD and UNCTAD 2003, p.86). Nevertheless, patent ownership is strongly skewed towards the North suggesting that, especially within the context of stronger IPR regulations under TRIPS,¹ it may well become increasingly difficult for developing countries to access clean technologies under favourable terms.

The opposite end of the IPR debate revolves around a claim that a lack of IPR law or the enforcement thereof in developing countries is the main barrier to low carbon technology transfer as firms that own new technologies fear infringement of their IPRs having often spent very large sums developing new technologies. Indeed, one rationale stated within the TRIPS agreement is that the protection and enforcement of IPRs will contribute to both increased FDI and the transfer and dissemination of technology (ICTSD and UNCTAD 2003, p.85). The argument is made that trans-national companies (TNCs) are unlikely to deploy cutting edge technologies that they have spent large resources developing in countries where they cannot ensure adequate patent protection.

Others see this as simple protectionism on behalf of powerful western economies. The US manufacturing sector in 1995, for example, had in excess of a \$20 billion trade surplus on licence fees and royalties on industrial processes sold abroad (UNCTAD-ICTSD 2003, p.37), which could be seen as a strong political incentive for pushing for stricter patent enforcement in developing countries, particularly within rapidly expanding markets such as China and India. This kind of surplus is not, however, reflected in all developed countries. The UK had a small surplus in 1995 (\$1.71 billion), whereas Japan and Germany both had deficits (\$3.35 billion and \$2.66 billion respectively) which were higher than many developing nations e.g. India \$68 million and Brazil \$497 million (Patel and Pavitt 1995 in UNCTAD-ICTSD 2003, p.37). This is, however, likely due to the fact that countries such as Germany and Japan rely more on exports to exploit their technological advantage, whereas the US and UK opt more for foreign direct investment (FDI) which involves more royalty payments. This raises important questions with regard to the overall benefits to developing countries of such trade relationships in the context of their access to, and technological capacity to work with, low carbon technologies – a point to which I return further below.

Several policy initiatives have been suggested on IPRs and low carbon technology transfer. These include creating a multilateral acquisition fund to buy up IPRs for low carbon technologies and tightening IPR regimes *a la* TRIPS. However, disagreements over whether, when and to what extent IPRs form a barrier to technology transfer mean that the value of such policy initiatives continues to represent a sticking point in negotiations between

¹ TRIPS, the agreement on trade related aspects of intellectual property rights, aims to create uniform IPR protection across developed and developing countries. It is administered by the WTO and has brought IPRs into international trade negotiations for the first time. Developing countries were given longer to conform than developed countries and least developed countries have until 2016 to conform.

developed and developing nations. However, as with low carbon technology transfer *per se*, very little empirical analysis has been done to inform this debate. As emphasised by a member of the UK Intellectual Property Office at a seminar in 2007: “Proposed changes to the existing [IPR] system must include significant evidence that a clear and identifiable need exists and that the change is the most appropriate way of addressing the need.” I turn now to the attempts that I am aware of to date to analyse the IPR issue in the context of low carbon technology transfer.

Research effort to date

I am currently aware of three attempts to engage with the issue of IPRs specifically in the context of low carbon technology transfer. The first, by John Barton (2007), looks at the issue via a case study based review of the markets for three renewable technologies (solar PV, wind and biofuels). The second, by Joanna Lewis (2007) of the Pew Center on Global Climate Change in the US, presents an in depth analysis of the wind power industry in China and India and is drawn on extensively in Barton’s analysis. The final study is Phase I of the UK-India study (Ockwell et al. 2006) which, on a case study basis, was able to make some tentative suggestions of IPR relevant insights, but did not have enough of an explicit IPR focus to be able to explore these in any depth. The case studies studied by Ockwell et al. were integrated gasification combined cycle (IGCC) for power generation, LED lighting, hybrid vehicles, biomass generation and improving the combustion efficiency of existing power stations.

Synthesis of key findings

In this section I summarise the key findings of the three studies listed above and raise an important concern with regard to the interpretation of their findings. In the following sections I go on to identify some cross cutting issues of general relevance to understanding low carbon technology transfer and highlight the areas that Phase II of the UK-India collaborative study ought to engage with.

Access to low carbon technologies

Developing country firms were found to have access to all the technologies listed above, although IGCC and hybrid vehicles in India were still at the R&D stage and seemed to be driven by indigenous R&D rather than access to internationally owned patented, or previously patented, technologies. Indian LED manufacturers were also not yet working with white LED lighting, although their Chinese counterparts are.

Importantly, developing country firms were generally not observed to have access to the most cutting edge technologies within the sectors examined. One exception is a Chinese firm, Sichuan FAW, that has gained access to Toyota’s cutting edge hybrid vehicle technology via a joint venture arrangement. The extent to which they have access to the underlying knowledge is, however, questionable as Toyota currently manufactures its Hybrid Synergydrive drivetrains in Japan and ships them to China for assembly.

Barton and Lewis’ analysis demonstrates how access to wind technologies in India and China has been facilitated via the acquisition of licenses from developed country firms and, in the case of India, also by strategic acquisition of developed country firms. In the case of solar

PV, China has pursued a strong policy of indigenous technology development, whereas India's access has principally been via a joint venture with BP Solar, suggesting future solar PV activity in India will be dependent on BP Solar's international market strategy. In terms of biofuels, Barton notes significant indigenous ethanol industries in China, India, Pakistan, Japan, Thailand and Malaysia as well as the notable success of Brazil in this sector.

Industry structure

Barton makes an important contribution in his analysis by highlighting the role that industry structure plays in determining access to new technologies. He argues that, whilst at least two of the renewable technologies that he studies (wind and solar PV) have a moderately concentrated market dominated by a limited number of large players, the industries are loosely structured enough to allow for new entrants and future market opportunities in developing countries are likely to incentivise technology diffusion.

Access to the cutting edge

Despite the overall optimistic tone of Barton's analysis, it is notable that for all of the case studies he examines, uncertainty is expressed as to the likelihood of developing country firms gaining access to the most advanced technologies in these industries. Companies owning patents to new thin film solar PV technologies and new enzymes being developed for biofuel production may be hesitant to make these available to developing country firms and the industries are concentrated enough that developed country firms could price developing country firms out of the market. Similar issues in terms of access to the know how behind cutting edge technologies were also raised by Indian firms in relation to IGCC and LED lighting in the UK-India study.

To some extent Suzlon, India's most successful wind technology manufacturer with the fifth biggest share of the global market, has overcome these issues by buying majority shares in developed country firms in order to gain access to cutting edge technologies such as variable speed turbines. Having said this, Barton identifies wind as the riskiest area in terms of access to future cutting edge technologies and markets for these. He cites the case of the US where GE has successfully used litigation over patent infringement to block foreign access to the market.

This point is reinforced by Lewis who explains how Suzlon and China's leading wind technology manufacturer, Goldwind, acquired access to wind technology by licence purchases from second tier developed country firms. This, she argues, was due to the disincentive for leading companies to license to potential developing country competitors, a concern accentuated by the cheaper labour and materials available in developing countries. The only companies willing to sell licenses to use their technologies are therefore smaller companies with less to lose in terms of competition and more to gain in license fees. Lewis does, however, note that this does not necessarily imply technological inferiority compared to larger companies, but the fact that the technology has been used less implies less operational experience and hence less opportunity to perfect and prove the technologies.

Barton notes that, even where they are not working at the cutting edge, access to finance for new technologies could be an issue for developing country firms. Venture capital funds tend

to favour new start ups with strong proprietary positions with regard to patented new technologies.

Mitigation vs. technological capacity development

The lack of access to cutting edge technologies raises an important issue. Is the concern with regard to low carbon technology transfer simply to achieve as rapid as possible deployment of these technologies in developing countries in order to mitigate greenhouse gases? In which case current market arrangements in relation to IPRs would not, on the basis of the technologies studied to date, seem to be acting as significant barriers. As Lewis puts it:

It took China and India less than 10 years to go from having companies with no wind turbine manufacturing experience to companies capable of manufacturing complete wind turbine systems, with almost all components produced locally. This was done within the constraints of national and international intellectual property law, and primarily through the acquisition of technology licenses or via the purchasing of smaller wind technology companies.

If, on the other hand, a more long term goal of sustained technological development in the area of low carbon technologies is also a significant consideration, then some important questions need to be asked as to the extent to which current arrangements are facilitating this.

As emphasised in the UK-India study, the key to ensuring long-term, sustained uptake of low carbon technologies in developing countries is the development of low carbon technological capacity within these economies. This relies on access to the knowledge that underpins cutting-edge technological developments, as well as exposure to the tacit knowledge that is often integral to developing the absorptive capacity necessary to work with emerging technologies. There are therefore potentially important concerns to be addressed in relation to the extent to which proprietary ownership of IPRs in relation to new advances in low carbon technologies might reduce developing country firms' access to the knowledge necessary for sustained low carbon technological capacity building. This is not the same as arguing that access to IPRs *per se* will facilitate such capacity building. Rather, it is to argue that access to IPRs may play an important role in enabling developing country firms to understand and work with/imitate the knowledge that underlies new low carbon technologies. This is a particularly relevant concern in the context of strengthened IPR regimes under the TRIPS agreement.

This issue is recognised by Lewis who highlights that countries are likely to pursue different strategies for obtaining low carbon technologies depending on the country's level of development. If the desire is to access advanced foreign technology without assimilating that technology into the local manufacturing base, IPR issues are likely to be less substantial as foreign companies can continue to sell that technology without the risk of local competition. If, however, the desire on behalf of the developing country is to assimilate new technologies and hence increase technological capacity, then developed country firms are more likely to use IPRs to prohibit access. In both cases, Lewis notes that cost can still be a major barrier to access.

Barton seems to recognise a similar concern in his conclusions. In relation to the development of cutting edge technologies, Barton highlights a potential future need for developed country governments to avoid the levels of national favouritism for patents

developed by public funding that have traditionally characterised the development of renewable technologies. He draws parallels with humanitarian licenses that have been granted in relation to agricultural and pharmaceutical technologies in the past. Barton also stresses the need to consider the subsidisation of research and development activities in developing countries. In a paper on the global scientific and technological commons, Barton (2008) goes even further to argue that it would be globally beneficial to establish a WTO style international treaty that attempted to remove barriers to the access of scientific and technological knowledge.

Cross-cutting issues

In all three studies, a number of cross-cutting issues were identified that are of relevance to understanding low carbon technology transfer. These are summarised below.

Firm level strategies

A key insight from Lewis' work, and one that Barton picks up on, is the extent to which the strategies pursued by the Indian wind power company, Suzlon, have been instrumental in gaining its current positioning as the fifth largest wind power company in the world. Both Suzlon and the leading Chinese wind company, Goldwind, obtained their technologies by licensing from developed country companies. Suzlon, however, has taken this further by purchasing majority control of several turbine technology suppliers. It also positioned itself strategically to take advantage of international learning and innovation networks (e.g. by basing its headquarters in the Netherlands) at the same time as bolstering domestic Indian networks. Strategic approaches to engaging with developed country firms were also noted as significant in the UK-India study in relation to past developments in the Korean automobile industry. It was also noted that developing country firms could adopt strategies that insisted upon less integrated transfer arrangements that maximise the use of host country labour and suppliers and therefore increase opportunities for technological learning.

Domestic policy and low carbon technology transfer

All three studies highlight the extent to which domestic policy can play a role in speeding the transfer and deployment of low carbon technologies. Lewis, for example, emphasises how India's domestic policy focus on renewables, including the introduction of feed-in tariffs and the easing of planning regulations, has done much to encourage the development of the wind power industry. The UK-India study highlights similar lessons in relation to generating markets for hybrid vehicles, although this is yet to be demonstrated within a developing country context. Lewis highlights the existence of local content requirements in China as having benefited Goldwind, although it is notable that Goldwind has not been nearly as successful to date as Suzlon. This, Lewis argues, is principally a result of Suzlon's strategic exposure to international learning and innovation networks.

Barton also sees domestic policy in developed countries as relevant in terms of creating barriers to developing country firms from gaining international exposure for their products. Examples include trade barriers in the US that prevent the import of Brazilian ethanol, nationalism in relation to patents arising from publicly funded research and development and the enforcement of patents in developed countries as a means of preventing developing

countries from gaining market access, as was observed in the US in relation to certain wind technologies owned by GE.

Absorptive capacity

All three studies noted that the absorptive capacity of developing country firms was likely to be equally important as any issues relating to IPRs important in determining access to low carbon technologies. This was corroborated in the UK-India study in face-to-face exchanges with Indian LED manufacturers. As argued above, however, a reciprocal link potentially exists between the terms of IPR access within technology transfer agreements and the development of absorptive capacity in developing country firms.

Key issues to engage with in Phase II

Based on the above discussion, a number of issues can be identified as warranting attention within Phase II of the UK-India study. These are summarised below.

Mitigation vs. technological capacity development

This issue, as detailed above, would seem to be a significant concern and one that warrants further attention during Phase II in relation to any reciprocal relationship between IPR access and the development of absorptive capacity and technological capacity more generally.

Sectoral focus

The three studies reviewed here represent a limited number of low carbon technologies. In particular, the more detailed analysis of IPR issues conducted by Lewis and Barton are limited to just three renewable energy technologies. This highlights a distinct need to broaden analysis to cover other types of technologies, including end-use technologies, network / infrastructure technologies and non renewable generation technologies. Whilst Phase I of the UK-India study engaged with some of these sectors, it was not possible to say with any certainty as to whether IPRs would represent a barrier to the transfer of the technologies at earlier stages of development, including LED lighting and hybrid vehicles.

Market based analysis vs. face-to-face interviews

The analysis presented by Barton and Lewis is largely based on the analysis of the market activities of developed and developing country firms in the sectors under consideration. Although it may be difficult to encourage firms to speak openly in relation to IPR issues, there is a distinct possibility that face-to-face interviews could yield significant additional insights into the key issues that developed and developing country firms perceive in relation to IPRs for low carbon technologies.

Competition and liberalised markets

Barton's analysis highlights the importance of attending to the role of competition and market incentives as driving factors in determining the extent to which IPRs play a role in enabling developing country access to low carbon technologies. This identifies technology transfer as

taking place within a free market context, with the additional market incentive of certified emissions reductions under the CDM. There is no reason to assume, however, that a free market approach should necessarily be sustained in relation to low carbon technology transfer in future. In view of the urgency of mitigating greenhouse gases related to the rapid development of certain countries such as India and China, it is perfectly feasible that governments might take a more interventionist approach to speeding low carbon technology transfer in future. Interventionist policy approaches to tackling low carbon technology transfer, including in relation to IPR issues, should therefore not be ruled out in any future analysis. Indeed, it is just such an interventionist approach that Barton seems to allude to when drawing parallels with humanitarian licenses that have been granted in relation to agricultural and pharmaceutical technologies in the past and when highlighting the need to consider the subsidisation of research and development activities in developing countries.

New approaches to IPR regimes

The studies discussed above base their analysis within the context of existing international patenting and licensing models. Interesting suggestions have, however, been made with regard to potential new IPR regimes that might more easily facilitate low carbon technology transfer to developing countries. These include, for example, Jerome Reichman's suggestion of a "compensatory liability regime" where royalties are collated by technology inventors on the basis of use e.g. in the music industry an artist would not own the rights to a song but instead receive a payment for every time the song was played.² It will be important for the work in Phase II to engage with such suggestions when developing policy recommendations in relation to IPRs.

Literature outstanding

There are range of additional sources of literature that the study might draw on which include both academic and more policy oriented literature. These include:

- The special issue of *Studies in Comparative International Development* that Lewis published in which may contain other papers with IPR related insights.
- The presentations and summary thereof of the Chatham House workshop on IPRs on Innovation and Diffusion of Climate Technologies requires re-visiting.
- Relevant work by the World Intellectual Property Organisation needs to be searched out and analysed.
- The work of the ICTSD Programme on IPRs and Sustainable Development needs interrogating.
- Cédric Philibert of the International Energy Agency has written a report entitled International Energy Technology Collaboration and Climate Change Mitigation that engages a little with IPRs. This report will also be of relevance to the Phase II work on collaborative R&D.

² Note: I may be misrepresenting Reichman's idea here – I need to check this with him.

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