Chapter 3

International Technology Cooperation for Addressing Climate Change: Political Feasibility and Implications for Asia

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3.1 Introduction

Development, transfer and deployment of low-carbon technologies make up one of the four building blocks of the future climate regime (the others being mitigation, adaptation and financing).

Development, transfer and deployment of low-carbon technologies make up one of the four building blocks of the future climate regime (the others being mitigation, adaptation and financing). Institutionalisation of technology transfer mechanisms at the international level has been a major demand of developing countries for a long time and it is likely to remain an important issue for negotiations in the future.[1] Through a series of national, sub-regional and regional consultations, we identified various types of barriers to collaborative technology development and transfer in Asia (IGES 2005, Srinivasan 2006). The barriers included high cost and capital intensity, the insufficiency of financing and investment, the unsatisfactory enabling environment, the rigidity of intellectual property rights (IPRs) regime, mismatch between technological needs and supply, limited domestic human capacity, and the lack of capacity in domestic institutions for adaptation, sustenance and dissemination of low-carbon technologies. Some stakeholders pointed out that most of the technologies developed to date are not based on considerations of natural resource endowments of developing countries. To overcome such barriers, many ideas and proposals were put forward, and these were reviewed in detail in our earlier report (Tamura 2006a). However, very few of these proposals considered the political and institutional feasibility of their implementation. Indeed, building political consensus on how to deploy new and existing low-carbon technologies in developing countries, while protecting the financial and intellectual property interests of those owning the technologies, will require significant creativity and reconciliation.

This chapter focuses on the political feasibility of selected post-2012 regime proposals for strengthening technology cooperation and assesses their implications for Asia. Political feasibility of policy proposals can be characterised as a policy proposal being acceptable enough to a majority of parties so as to overcome resistance that would inhibit the policy's adoption and/or implementation (de Coninck et al. 2007). Instead of directly asking whether a proposal is acceptable or not, this chapter looks at the issues of "participation" and "compliance", and examines how and to what extent each policy proposal is designed to address these issues. Participation refers to whether a state becomes a party to an international agreement, and compliance means the degree to which a state that is a party to such an agreement implements the obligations of the agreement. Any international technology cooperation for addressing climate change needs to be sustained long enough to deliver on environmental effectiveness. Adequately addressing the issue of participation and compliance is, therefore, critically important.

After briefly assessing the status of international technology cooperation for climate change, proposals in three priority areas, where future discussions can make a difference

1. At COP13 held in Bali in December 2007, the importance of technology development and transfer was again recognised and the Expert Group of Technology Transfer (EGTT) was given new mandates to develop recommendations for strengthening technology transfer.

to achieve the goal of rapid uptake of low-carbon technologies especially in developing Asia, are examined. Drawing from international relations/political science literature as well as empirical cases of China's experience with the Montreal Protocol on Substances that Deplete the Ozone Layer, an analytical framework is developed. Then, the political feasibility of each proposal is assessed in terms of how each addresses the issue of participation and compliance. The chapter concludes by suggesting the way forward to enhance the political feasibility of international technology cooperation under a future climate regime.

3.2 Status of International Technology Cooperation

A detailed assessment of the status of international technology cooperation in climate regime was given in our previous report (Srinivasan 2006), where we examined how different articles of the United Nations Framework Convention on Climate Change (UNFCCC) (Articles 4.1, 4.3, 4.4, 4.5 and 4.7) and its Kyoto Protocol (Articles 3.14, 10 (b), (i) and (c), and 11.2), and various decisions of the Conferences of the Parties (COPs) to the UNFCCC (Decision nos. 13/CP1, 7/CP2, 9/CP3, 4/CP4, 5/CP4, 9/CP5, 4/CP7, 5/CP7, 10/CP8, 1/CP10 and 6/CP10) referred to promoting international cooperation in development, transfer and deployment of technologies. The Global Environment Facility (GEF), which is the main financial mechanism of the Convention, disbursed about USD 250 million per year to support energy efficiency improvement, enhancement of the use of renewable energies, and sustainable transportation projects in developing countries. However, technology transfer in these projects was considered minimal. Likewise, after assessing the role of funds such as the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDC Fund) in promoting technology cooperation, it was concluded that the efforts by the UNFCCC and the GEF were of modest significance at best (Tamura 2006a).

The clean development mechanism (CDM) under the Kyoto Protocol was meant to facilitate technology transfer indirectly, but stakeholders in our consultations repeatedly pointed out that there were very few projects where such transfer was seen, especially for technologies with high GHG mitigation potential. As per the claims on technology transfer made by project developers in their project design documents, roughly one-third of all CDM projects involved technology transfer (Haites et al. 2006). Natsource[2] also reported that the Netherlands (landfill gas projects), France (N_2O reduction), Spain and Denmark (wind energy) shared their expertise in setting up several CDM projects in developing countries, which also contributed to technical capacity in the host countries. Several researchers, however, indicated that the administrative complexity of project-based mechanisms restricted the ability to bring about technology shifts in developing countries (Bell and Drexhage 2005), and that incentives to develop more advanced technology on a long-term basis were weak (Sandén and Azar 2005). In Asia, the predominance of unilateral CDM projects (especially in India), and HFC destruction projects that produce a large amount of certified emission reductions (CER) (especially in China and the Republic of Korea) also indicates very limited prospects for effective technology transfer from developed countries.

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2. http://www.ecn.nl/en/ps/news/item/article/177/1280/

In our previous report, we examined the role of plurilateral and bilateral technology initiatives (e.g. International Energy Agency (IEA) implementing agreements, Asia-Pacific Partnership on Clean Development and Climate (APP), Methane to Markets Partnership (M2M), Gleneagles Plan of Action on Climate Change, Clean Energy, and Sustainable Development) outside the UNFCCC. This is an area where the US launched several technology-oriented initiatives after withdrawing from the Kyoto Protocol. We noted some positive results through such efforts (e.g. supply of power generation equipment for a 120 MW coal bed and coal mine methane power plant in China through the M2M Partnership). However, such cooperation, which is usually seen as the most feasible option for US international leadership, is not immune to implementation problems (Tamura 2006b).

While both UNFCCC and non-UNFCCC initiatives may potentially enable Asian countries to access climate-friendly technologies, more effective forms of technology cooperation need to be developed.

In sum, while both UNFCCC and non-UNFCCC initiatives may potentially enable Asian countries to access climate-friendly technologies, more effective forms of technology cooperation need to be developed. Any form of international cooperation, first of all, needs to ensure the participation of states, and also requires participating states to adjust their policies according to agreements and make such commitments credible (Keohane 1984). Policy proposals for international technology cooperation, thus, need to give adequate attention to the issues of participation and compliance.

3.3 Three Priorities for Strengthening Technology Cooperation

Based on multi-stakeholder consultations in Asia, we recognised three priority areas where future climate regime discussions can make a difference to achieve the goal of rapid uptake of low-carbon technologies. These are improving finance, building synergies between the UNFCCC and the non-UNFCCC initiatives, and enhancing the flexibility of IPRs for low-carbon technologies. This section examines the relevance of two proposals for each priority area. The choice of proposals is based upon opinions of participants in our consultations and observation of international discussions.

3.3.1 Improving finance to accelerate technology cooperation

Currently, funds available under the UNFCCC are not large enough, and the price signals under the Kyoto Mechanisms are still too weak to mobilise the amount of capital on the scale required.

Currently, funds available under the UNFCCC are not large enough to finance the costs associated with the technological changes that need to occur in developing countries. Further, the price signals under the Kyoto Mechanisms are still too weak to mobilise the amount of capital on the scale required. Therefore, several ideas were put forward for securing financial resources for technology research and development (R&D) and transfer.

One approach is to increase financial contributions to technology cooperation as part of commitments by Annex I countries under the Kyoto Protocol. The Sao Paulo Proposal, an outcome of the BASIC Project, recommends a Technology Funding Mechanism, wherein funds are secured by imposing a 2% levy on international transfers of all carbon credits except CER (i.e. Assigned Amount Units (AAUs), Emission Reduction Units (ERUs) and Removal Units (RMUs)) and by allowing financial contributions as part of legally-binding commitments of Annex I Parties (BASIC 2006).[3] The Mechanism may support non-Annex

3. The Sao Paulo Proposal suggests that each Annex I Party should convert its legally-binding emissions reduction commitment into a combination of an absolute emission limits (tCO_2e/year), emissions intensity limits (tCO_2e/ unit GDP), and new and additional funding (USD per year) to a maximum of 10% of its commitments.

I Parties participation in international R&D initiatives of mitigation and adaptation technologies, and may also undertake such initiatives directly. Based upon requests from non-Annex I Parties, it may also be used to buy relevant technologies for widespread dissemination in developing countries.

Another proposal is to establish a protocol for a global technology R&D fund (Barrett 2003). In this scheme, developed countries would be expected to contribute funds based upon the principle of ability and willingness, as in the UN scale of assessments, or upon the measures of each country's historical responsibility for climate change or current GHG emissions. This funding scheme, Barrett recommends, should build in a strategy of reciprocity. Namely, if country *i* accedes, then all the other parties will increase their funding by a specific amount. On the other hand, if *i* withdraws, the others will lower their funding. Barrett proposed a similar mechanism for technology transfer (as opposed to technology development) akin to the Montreal Protocol's Multilateral Fund.

3.3.2 Building synergies between UNFCCC and non-UNFCCC initiatives

Technology development and transfer is a cornerstone of several new non-UNFCCC initiatives such as APP. However, initiatives to build synergies between UNFCCC and non-UNFCCC initiatives are still lacking. One approach is to make project and/or programme activities with significant technology components under non-UNFCCC initiatives eligible for preferential treatment under the CDM. For example, synergy can be built in a process through which the M2M Partnership facilitates a better access to markets for coal mine methane project developers in China. As the climate regime provides unique CDM opportunities in methane recovery and additional income for project developers, many providers of coal mine and coal bed methane recovery technology, who are also members of the M2M Partnership, recognised the potential for carbon revenue (Point Carbon 2006). However, it remains to be seen if M2M-sponsored projects contravene CDM additionality rules.

Technology development and transfer is a cornerstone of several new non-UNFCCC initiatives. However, initiatives to build synergies between UNFCCC and non-UNFCCC initiatives are still lacking.

Another approach to encourage synergies is through sector-based technology standards (Barrett 2003), energy efficiency standards (Ninomiya 2003) or a sector-based crediting mechanism (Schmidt et al. 2006). Internationally-agreed technology targets or efficiency standards can provide a "pull" incentive to commercialise new, low-carbon technologies, and help participating countries to establish or enhance such "market-pull" mechanisms at the national level. These proposals explicitly or implicitly assume the reference to best available technologies or relative energy efficiency in specific sectors across countries. To compare the relative energy performance of industries, however, it is necessary to recognise that individual technologies, qualities of feedstock and products are often different in various countries even for the same industry. Reliable comparisons also require that the quality of data should be ensured and continuously updated. System boundaries and definitions also need to be uniform. However, there has been no common methodology for such comparisons so far. Against this backdrop, the G8 Gleneagles Plan of Action mandated the IEA to take an initiative in assessing industrial energy efficiency worldwide (IEA 2007). The two task forces of the APP, those of the steel and the cement sectors, also began to establish common methodologies for setting energy-efficiency benchmarks in each sector. Likewise, the Cement Sustainability Initiative of the World Business Council for Sustainable Development (WBCSD), and the task force of the International Iron and Steel Institute (IISI) have begun to develop global sector-specific approaches for emission reductions.

Development of reliable methodologies for benchmarking through the non-UNFCCC initiatives could become an important building block of a post-2012 climate regime, if it adopts sector-based commitments. Some initial progress along these lines has been evident in the "Bali Action Plan" agreed upon at the recently concluded COP13 in December 2007. The Ad Hoc Working Group on Long-term Cooperative Action under the UNFCCC, a newly established body at COP13, agreed to address "cooperative sectoral approaches and sector-specific activities". Even if sector-based commitments are not fully adopted in a post-2012 regime, a sector-based benchmarking methodology can contribute to the development of a technology-based and bottom-up approach for differentiating national emissions targets.[4] In a nutshell, energy-efficiency benchmarks and emissions reduction potentials that non-UNFCCC sector-based initiatives are developing can serve as a foundation for concerted future actions under the UNFCCC.

3.3.3 Enhancing flexibility of intellectual property rights for low-carbon technologies

There are sharp disagreements between developed and developing countries with regard to treatment of IPRs for low-carbon technologies.

There are sharp disagreements between developed and developing countries with regard to treatment of IPRs for low-carbon technologies. For example, shortening the duration of IPR protection was repeatedly raised by developing country participants in our consultations, while participants from developed countries argued that technology developers need to recuperate the costs for R&D over time. One approach to reconcile such disagreements is to pursue collaborative R&D initiatives at an early stage of technology development, so that both developed and developing countries could potentially enter into joint ownership of IPRs. As mentioned earlier, the Sao Paulo Proposal suggests the creation of the Technology Funding Mechanism, which could be structured to facilitate the participation of developing countries in international R&D initiatives (BASIC 2006). Another idea is to create an international association that coordinates and develops new technologies, thereby holding IPRs in a pattern similar to that of the Consultative Group on International Agricultural Research (CGIAR) (Ogonowski et al. 2004). Establishment of a new international fund for purchasing and dissemination of climate technologies has been proposed by developing countries at UNFCCC.

An approach to enhance the flexibility of the IPR regime for already commercialised technologies is along the lines of approaches taken to combat HIV/AIDS (e.g. compulsory licensing) (Ockwell et al. 2007, Ogonowski et al. 2004). One participant in our consultations suggested that the US Clean Air Act might be a better example than HIV/AIDS to pursue compulsory licensing and deployment of low-carbon technologies.[5] The BASIC project also suggested another approach to utilise the proposed Technology Funding Mechanism to buy out IPRs, and make privately-owned, climate-friendly technologies available for deployment in developing countries. This approach was similar to the proposal of a Multilateral Technology Acquisition Fund, as recommended by the South African Ministerial Indaba on Climate Action in 2006.[6]

4. This is similar to so-called "triptych" approach that was developed in the context of internal EU negotiations about allocation of the EU's Kyoto target among member states.
5. Section 308 of the Clean Air Act provides a mechanism by which such a non-complying party may obtain a patent license where it has been unsuccessful in its attempts to obtain a license on its own.
6. Available at http://unfccc.int/files/application/pdf/20060626_indaba.pdf

3.4 Political Feasibility of Technology-oriented Proposals

Drawing upon basic analytical frameworks of International Relations, this section outlines two perspectives on political feasibility of international technology cooperation. One perspective focuses on international incentive mechanisms for participation and compliance. The other examines domestic political processes through which a decision on participation is made and actual implementation occurs. It also examines how successful examples of China's participation in, and implementation of, the Montreal Protocol on substances that deplete the Ozone layer benefited from both international incentive mechanisms and domestic interests. The Montreal Protocol is taken as an example because it is often seen as successful in terms of both the participation of major developing countries and the rapid uptake of non-Chlorofluorocarbon (non-CFC) technologies. While there are alternative explanations for its success (e.g. the Dupont Hydrochlorofluorocarbon [HCFC] claim (Oye and Maxwell 1994) and the epistemic communities claim (Haas 1992)),[7] it is reasonable to conclude that implementation of the actual agreement and uptake of non-CFC technologies occurred largely because of incentives and a close fit with domestic interests. Theoretical and empirical arguments suggest the importance of structuring an international agreement that is self-enforceable, includes side-payments, appeals to domestic interest groups, and is capable of overcoming domestic administrative fragmentation.

Theoretical and empirical arguments point to the importance of structuring an international agreement that is self-enforceable, includes side-payments, appeals to domestic interest groups, and is capable of overcoming administrative fragmentation.

3.4.1 Systemic-level perspectives on the feasibility of technology cooperation policy: Incentive structures at the international level

A systemic-level approach focuses on the question of how states calculate gains from cooperative arrangements under international anarchy, namely in the absence of a centralised authority to enforce promises or provide protection among states. This approach is based upon a key assumption that states are unitary-rational actors whose core interest is not only to improve their well-being but also to attain survival and independence.[8] The effect of anarchy on the behaviour of the state is assumed as follows: (a) states worry that partners may cheat them and be free-riders, and (b) states are concerned that gains from cooperation may favour partners in relative terms. These assumptions lead to two distinct propositions.

A systemic-level approach suggests that a state agrees with and adheres to an international agreement if its collaborative arrangements are expected to make the state better off, and produce "balanced" achievements of gains.

P_1: International cooperation needs to be self-enforced–i.e. the cooperation should be incentive-compatible so that states reach and adhere to agreements, because doing so is in their interests (Barrett 2003).

P_2: A state will decline to join, will leave, or will sharply limit its commitment to a cooperative arrangement if it believes that gaps in otherwise mutually positive agreements favour partners (Grieco 1990).

Political feasibility can therefore be examined, on the one hand, in terms of how international arrangements could create incentives for participation or disincentives for defecting from agreements, and on the other hand, to alleviate states' concerns

7. The former emphasises the coincidence with producer interest, and the latter focuses on transnational diffusion of norms and ideas through "epistemic communities", defined as a network of experts who share common policy goals, concerns over issues, and specialised knowledge.
8. A state as a unitary actor means that a state is regarded as a united front and in full control of its society. In other words, a state is seen as a "black box."

over gaps in gains. The Montreal Protocol provided two incentive mechanisms: trade restrictions between signatories and non-signatories in the ozone-depleting substances (ODS) controlled by the treaty, and compensation to developing countries for covering "incremental costs" of complying with the agreement through the Protocol's Multilateral Fund (MLF). Barrett argues that "[it] is really the combination of carrots and sticks that succeeded in protecting the earth's ozone layer" (Barrett 2003: 351).

Indeed, the MLF was a key driving force in China's ratification of the Montreal Protocol, as the Protocol had the potential to hurt many growing industries such as household refrigerators, fire protection and foams. Besides being the largest ODS consumer and producer among developing countries, China lacked the financial and technical capabilities to substitute other chemicals for ODS. Therefore, it insisted that developing countries could not afford the costs of CFC abatement since they needed to address more pressing domestic issues such as poverty alleviation (Zhao and Ortolano 2003). After heated negotiations, the 1990 London Amendments to the Montreal Protocol established a new mechanism for transferring funds and technologies to developing countries (i.e. the MLF). In 1991, China finally ratified the London Amendments.

With regard to the adoption of non-CFC technologies in China, another study presented additional insights. While the MLF helped domestic market-oriented industries in China gradually adopt reduced-CFC technologies, it was market pressures from international trading partners that much more rapidly motivated export-oriented household refrigeration manufactures to adopt such technologies (Zhao and Ortolano 1999). Environmental labelling restrictions in export markets worked as a major force in causing many Chinese refrigerator manufacturers to stop using CFCs. This study provides an implication for the systemic-level approach. Once it makes unequivocal economic sense to join a technology diffusion agreement, targeted technologies could become standards (Barrett 2003). In that case, joining agreements and following standards would be a better strategy than non-participation.

In short, this systemic-level approach suggests that a state agrees with and adheres to an international agreement if its collaborative arrangements are expected to make the state better off, and produce "balanced" or "equitable" achievements of gains. This approach provides two indicators. One is the existence and magnitude of incentives: whether and how an international agreement can create a situation where states find it beneficial to adhere to the agreement's provisions. The other is the extent to which international technology cooperation is designed to offer side-payments. The provision of such side-payments is expected to mitigate inequities rising from cooperative arrangements.

A domestic-level approach allows for the possibility that a government, however sincere about its international commitments, may be unable to deliver because of domestic political or administrative constraints.

3.4.2 Domestic-level perspectives on political feasibility

Unlike the systemic-level approach which regards the state as a unitary actor pursuing aggregate, national interests, a domestic-level approach opens up the "black box" of the state and examines domestic political interactions through which decisions on participation and implementation occur. Various actors, including central government bureaucracies, local governments and industries are involved in such interactions, and they have different, potentially conflicting objectives. This approach allows for the possibility that a government, however sincere about its international commitments, may be unable to deliver because of domestic political or administrative constraints.

The domestic-level approach is built upon four major assumptions: (a) the state is seen as an institutional structure, where decisions and policies are formed through a series of political interactions over which no single actor has full control; (b) domestic political structures partly define the distribution of authority and power among actors; (c) domestic actors develop their policy preferences in terms of the degree to which a policy serves and satisfies their fundamental objectives or interests, but their preferences sometimes differ, and none will necessarily be fully consistent with that of the nation or state at large, and (d) the perspectives and interests of domestic actors are largely shaped by their role and position.

Taken together, these assumptions suggest that implementation and compliance are subject to the domestic distribution of costs and benefits caused as well as the distribution of authority and power over domestic policy-making and implementation processes. Two propositions are as follows:

P_3: It is easier to domestically implement those international commitments that offer tangible benefits to some specific groups while costs are widely dispersed throughout society. Conversely, it is harder to carry out those commitments that impose disproportional costs on specific sectors or groups even though benefits are widely dispersed.

P_4: Domestic implementation of international commitments becomes more difficult in an issue/area where authority over policy-making and implementation processes is fragmented.

Here, China is considered an example to examine domestic perspectives of political feasibility of international technology cooperation. In China, central government bureaucracies are at the core of planning and policymaking, while local government authorities play a pivotal role in implementation. These bureaucratic organisations have their own organisational goals: (a) to defend the essential mission or purpose of the bureaucracy; (b) to defend/expand the bureaucratic "turf"; (c) to maintain organisational autonomy; (d) to maintain morale within the organisation (which serve to make sure the organisation functions well), and (e) to make sure that the organisational budget grows (Halperin and Kanter 1973). International agreements can be utilised to strengthen bureaucracies' autonomy and improve their maneuverability over domestic politics (Putnam 1988).

In China, central government bureaucracies are chiefly responsible for planning and policymaking, while local government authorities play a pivotal role in implementation.

Several studies concluded that implementation of the Montreal Protocol fit the interests of China's principal implementing agency. Given the inter-agency rivalries, the National Environmental Protection Agency (NEPA) had a particular interest in implementing the Montreal Protocol effectively (Zhao and Ortolano 2003).[9] It was the Ministry of Foreign Affairs, not NEPA, which had previously involved authorities to participate in negotiations over multilateral environmental agreements. In addition, NEPA did not regulate the domestic implementation of multilateral environmental agreements. By demonstrating its capability to effectively implement the Protocol, NEPA saw the possibility to extend its domain. Working with the MLF also gave NEPA access to administration and power to allocate MLF money. Thus, NEPA believed that the Montreal Protocol could provide an

9. The NEPA was upgraded to a full ministry and renamed the State Environmental Protection Administration (SEPA) in 1998.

opportunity to extend its authority over international negotiations, enhance its domestic execution of Multilateral Environmental Agreements (MEA), and reinforce its domestic political position.

With regard to the domestic political structure of China, fragmentation is a key feature. The fragmentation of authority for economic (Lieberthal and Lampton 1992, Lieberthal and Oksenberg 1998, Oksenberg and Economy 1998, Ohshita and Ortolano 2006) and environmental (Jahiel 2000) policymaking in China is well-documented. Furthermore, it was argued that the reforms beginning in the late 1970s accelerated such fragmentation. The decentralisation of budgetary authority, for instance, made many locales less sensitive to the policy demands from higher levels or central government. Consequently, institutional fragmentation and a lack of sufficient authority, combined with prevailing local interests in economic development, proved to be the main constraints for domestic implementation of international commitments (Ohshita and Ortolano 2006). The other developing countries in Asia also suffer from similar, if less severe, problems with administrative fragmentation and the related complex of predicaments that hinder environmental regulations in rapidly growing economies (Chan 1993, Eder 1996, Rock 2002, Heller and Shukla 2003).

Overcoming institutional fragmentation is critical...though NEPA was reluctant to relinquish its privileges in MLF funding management, it recognised the problems caused by excluding local environmental protection bureaus.

Overcoming such institutional fragmentation is critical. As previously mentioned, NEPA initially managed preparation and submission of the MLF proposal, and implemented individual MLF-supported projects. However, implementation of the MLF suffered, since local environmental protection bureaus (EPBs) were not involved in the process. It was local EPBs that had access to data on ODS consumption and production, especially from small and medium-sized enterprises. Likewise, it was local EPBs that enforced regulations issued by NEPA. Even though NEPA was reluctant to relinquish its privileges in MLF funding management, it recognised the problems caused by excluding local EPBs. Finally, local EPBs were integrated into the administrative structure for policy implementation, which facilitated the domestic process of applying for the MLF (Zhao and Ortolano 2003).

This line of thought suggests two elements of political feasibility: (a) the degree of which policy outcomes appeal to, or diverge from, the interest of key actors at the implementation stage; and, (b) the degree of fragmentation of authority in a policy-making process under specific technology cooperation. The domestic political process perspectives on political feasibility discussed above are summarised in Table 3.1, along with the systemic-level perspectives discussed previously. The next part of the section will consider how each proposal addresses the identified indicators of political feasibility.

Table 3.1 Key elements of political feasibility

International level	
1. Self-enforceability	How and to what extent can international arrangements create a situation where participation and compliance are in the interest of states?
2. Provision of side-payments	How and to what extent do international arrangements compensate to mitigate inequities rising from cooperative arrangements?
Domestic level	
3. Fit with domestic interests	To what extent do expected outcomes of international cooperation appeal to, or diverge from, the interest of key actors in implementation?
4. Domestic institutional fragmentation	To what degree is authority in the domestic policy-making process under specific technology cooperation fragmented?

3.5 An Assessment of the Political Feasibility of Selected Proposals

3.5.1 Proposals for improving financial capacity

Enhancing financial contributions to collaborative R&D and technology transfer as part of legally-binding commitments by Annex I countries would give Annex I countries greater flexibility.

The proposal of enhancing financial contributions to collaborative R&D and technology transfer as part of legally-binding commitments by Annex I countries aims at providing stimulus for technology development and transfer, while preserving the basic structure of the Kyoto Protocol. The proposal gives Annex I countries greater flexibility in achieving their commitments, as each developed country could determine its own mix of emission reduction and financial commitments. Such an expansion of flexibility can be seen as a compensation mechanism for the countries subject to legally-binding emissions reduction commitments. However, the basic structure of the Kyoto Protocol on which this proposal is built poses a challenge to self-enforceability of commitments by Annex I countries. Some scholars argue that the Kyoto Protocol has the enforcement problem, since it does not provide sufficient incentives to secure participation and compliance (Victor 2001, Barrett 2003, Hovi et al. 2003, Nentjes and Klaassen 2004).

The above proposal may appeal to the recipients of technology at the domestic level in developing countries. The modality of how information on available funds is shared and disseminated among local governments and industries, however, has significant implications for effective implementation. As China's experience with the MLF showed, the lack of adequate involvement of local stakeholders can lead to political obstruction.

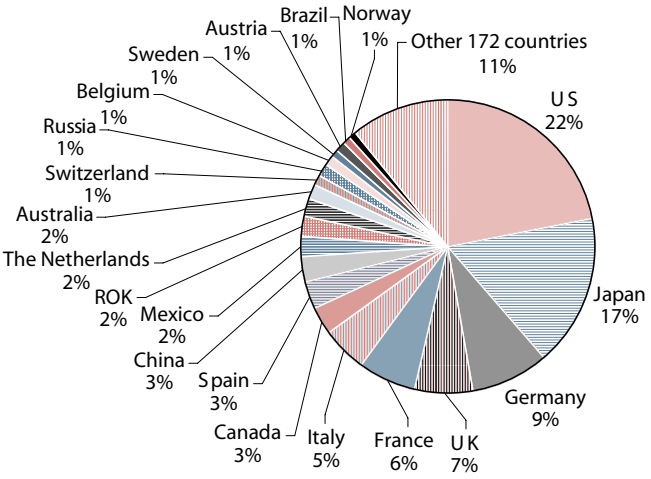
For Annex I countries, however, domestic responses may be mixed. The proposal may appeal to the developers of low-carbon technologies that anticipate new opportunities for exporting such technologies. However, the idea of financial contributions as part of legally-binding commitments is likely to face opposition from finance ministries. Indeed, in Japan, the Financial System Council of the Ministry of Finance expressed concerns over the cost of purchasing emission allowances from abroad to meet the Kyoto target, which was estimated at JPY220 billion to 1.2 trillion (*Ecology Express* 26 October 2007, 19 November 2007). In many developed countries, reconstruction and maintenance of sound fiscal status are now major policy priorities, and finance ministries have organisational interests to pursue such priorities.

With regard to the global R&D fund proposal, the financial contribution is based upon three conditions: (i) an agreed total expenditure level; (ii) a share for each country determined by its circumstances (shares may be based on the UN scale of assessments or historic and/or current emissions, and so on); and (iii) the other countries' contributions (Barrett 2003). Proponents of the global R&D protocol deliberately address the enforcement problem, by arguing that a funding contribution scheme should build on a strategy of reciprocity, which could create incentives to participate. Furthermore, the idea of sharing costs of R&D itself also provides incentives for both developed and developing countries. However, the modality for determining a share for each country's contribution might give rise to a relative gains problem. If the UN scale of assessments is adopted to define shares of financial contribution, burdens of cost-sharing would be concentrated in a few countries. As Figure 3.1 shows, the current share of the US and Japan amounted to nearly 40% of the total UN regular budget in 2007. Such a high portion of cost-sharing for R&D may raise concerns about fairness, especially when the amounts involved are large. Even if the share of contribution is to be based on each country's historical and

Implementing the global R&D fund thus presents a dilemma: the greater the amount of the fund needed, the less likely the participation from major contributors.

current emissions, reaching a politically acceptable agreement is not easy. For example, questions may come up such as the period from when to consider historical emissions and whether or not emissions from land-use, land-use change and forestry (LULUCF) are to be included. These questions may very well result in another long political battle. Implementation of the global R&D fund thus presents a dilemma: the greater the amount of the fund needed, the less likely is participation of the major contributors.

Figure 3.1 Contributions to the UN regular budget based on the UN scale of assessments (2007)



As per the latest reports of IPCC, the total public funding for energy technologies in IEA countries had in fact declined soon after the initial interest created through the oil shock in the 1970s levelled off, despite the fact that the UNFCCC was ratified much later (IPCC 2007). The global R&D fund proposal intends to change this trend. At the domestic level, the idea of the global R&D fund may appeal to the energy sector in both developed and developing countries, since an increase in public R&D budgets can be expected. Similarly, the proposal may be of interest to industrial/energy ministries, as international agreements on R&D may strengthen their manoeuvrability in pursuit of such organisational objectives as the expansion of the bureaucratic turf and the increase in their organisational budget.

The global R&D proposal may however encounter resistance from finance ministries in donor countries. One solution to alleviate such concerns is to set a limit on the total financial obligations for each country, so that parties to the R&D protocol will know the maximum cost of participation before deciding to ratify (Barrett 2003). This may be one advantage as compared with the proposal for enabling financial contributions as part of mandatory commitments, where compliance costs are uncertain and agreements on deeper cut of GHG emissions can lead to further uncertainty.

It is important to encourage private investments in low-carbon technologies not only for technical (i.e. avoiding technology lock-in) but also political reasons (i.e. keeping the amount of public R&D fund at a reasonable size).

It is also critically important to encourage private investments in low-carbon technologies not only for technical (i.e. avoiding technology lock-in) but also political reasons (i.e. keeping the amount of public R&D fund at a reasonable size). It was recently pointed out that additional investment and financial flows needed to return global GHG emissions to current levels in 2030 would be USD 35-45 billion in energy research, development and deployment alone (Haites 2007).[10] In contrast, governments

10. "Additional" investment in a particular year means the difference between the necessary flows and a reference scenario in that year.

of the US and Japan, the two largest investors in energy R&D, spent USD 3.38 and 2.45 billion, respectively, between 1977 and 1999 (Sagar and van der Zwaan 2006). While it is necessary to increase the public R&D budget significantly, public money alone cannot meet the total investments needed. Therefore, further efforts to orient private investments for low-carbon technologies can minimise political overload of international cooperation for technology finance.

Arguments on political feasibility of proposals for improving financial mechanisms are summarised in Table 3.2.

Table 3.2 Political feasibility of proposals for improving financial mechanisms

Key Elements of Political Feasibility	Financial mechanism linked with mandatory requirements	Global R&D protocol
Self-enforceability	✓	✓✓✓
Side-payments	✓✓	✓
Domestic interests	✓✓	✓✓
Domestic institutions	✓	✓

Legend: ✓✓✓addressed in depth ✓✓addressed in some detail ✓addressed very little

3.5.2 Assessment of proposals for building synergies between UNFCCC and non-UNFCCC initiatives

The proposal to enable project and/or programme activities with significant technology components under non-UNFCCC initiatives eligible for preferential treatment under the CDM can provide non-Annex I countries with an additional opportunity for investments in low-carbon technologies. Asian countries with large domestic mitigation potential such as China, India, Indonesia and the Republic of Korea, who are also members in many non-UNFCCC technology initiatives, are most likely to benefit from this sort of mechanism. For example, China is a member of several non-UNFCCC initiatives, including the APP, the M2M Partnerships, the Carbon Sequestration Leadership Forum (CSLF) and the International Partnership for the Hydrogen Economy (IPHE). The greater flexibility in the Kyoto Mechanisms may help developed countries to fulfil their legally-binding commitments more easily. However, as noted before, incentives created by the Kyoto Mechanisms need to be supported by strong enforcement, which remains as a challenge.

Enabling project and/or programme activities with significant technology components under non-UNFCCC initiatives eligible for preferential treatment under the CDM can provide non-Annex I countries with an additional opportunity for investments in low-carbon technologies.

The proposal may also bring further opportunities for domestic industries in developing countries. As major host countries of CDM projects, China and India have large potential to attract additional technology investments. It is estimated that as much as 50% of CER from CDM projects are likely to come from China by 2012. Project developers in countries that did not ratify the Kyoto Protocol (e.g. US) could also expect better market access to their technologies, if synergies are built between UNFCCC and non-UNFCCC initiatives.

While sectoral approaches have a range of variations, the political feasibility is examined here for only two proposals: technology standards (Barrett 2003) and sectoral crediting mechanism (Schmidt et al. 2006). International technology standards may create a network externality by making it attractive for states to enforce such standards. For example, access to the markets of the major consuming countries provides a powerful market incentive for industries in developing countries to conform to the regulatory environment of importing countries. It is true that, as one participant in our consultations

pointed out, there are some important technologies (e.g. CO_2 capture and storage) to which such network effect would not be applicable. For such technologies, cost constraints may be more critical in determining market penetration than accessibility (Philibert 2004). With regard to tradable goods, however, there is substantial evidence of a "California effect", i.e. nations are increasingly adopting the standards of their richer, greener trading partners (Vogel 1995, Vogel 1997).

Improving energy efficiency is likely to appeal to the self-interest of many countries in Asia. There is nevertheless reluctance to link domestic energy efficiency measures to international commitments.

Improvement of energy efficiency is of self-interest to all countries, since it saves energy costs, and contributes to energy security and reduction in local air pollution. Indeed, many Asian countries, including China, India, the Philippines, Thailand and Viet Nam, have taken several domestic measures to conserve energy. However, there is nevertheless reluctance to link such domestic measures to international commitments. It was reported that a proposal to include a regional target of energy efficiency improvement in the Singapore Declaration of the East Asia summit encountered strong opposition from India (*Asashi Shinbun* 4 November 2007). Their view partly reflected a fear that such commitments on a regional basis may lead to national emissions control targets under a future international regime. A senior negotiator from India at our consultations pointed out that commitments based on energy intensity would not be acceptable as energy intensity depends upon both energy efficiencies of different sectors and sectoral shares of GDP. Extrapolation of current energy intensity levels into the future is considered inappropriate as the relative growth rates of different sectors in the future are uncertain for many developing countries. It was stressed that harmonisation of energy efficiency standards in developing countries with those of industrialised countries would not necessarily be advantageous to the former because of wide differences in natural resource endowments. To alleviate such concerns, some incentives must be provided. The sectoral crediting mechanism envisages two incentive mechanisms to reward or compensate the GHG mitigation efforts by developing countries. One is that those countries that reduce their sectoral GHG emissions below no-lose, pledged targets would be awarded emission reduction credits that could be sold to developed countries. On the other hand, failure to fulfil the pledged level would not incur any penalties. In addition to the crediting mechanism, the proposal suggests another incentive mechanism called "technology and finance package" to financially support the deployment of advanced technologies, pilot projects and capacity building.

A general pattern of domestic cost/benefit distribution in the sectoral approaches is that efficient companies might find sectoral approaches attractive while costs of compliance are imposed on less efficient ones at least in the short-term. In sectoral crediting mechanism, a decision on how to distribute emission credits and financial resources among stakeholders adds a political twist. To sell the idea of sectoral crediting mechanism to domestic industries, the government may need to devise an equitable distribution mechanism to strike a balance between rewards for efficient companies and compensation for companies bearing high compliance costs.

International technology standards may be appealing to some domestic actors in developing countries, as harmonisation of standards can lower the fixed costs of export goods. Harmonisation can save money by eliminating the need to develop separate equipment to adhere to different technology standards in various countries. National adoption of international standards can also reduce administrative costs of establishing domestic technology standards, as many implementing agencies in developing

countries already suffer from inadequate budgetary and human resources. In the case of automobile emission standards, for example, even those countries that do not export to the US have an incentive to adopt the same standards. This is partly because international technology standards presented an opportunity for policymakers in those countries lacking such resources to emulate (Faiz et al. 1996).

Domestic institutional arrangement and industrial structures may raise a concern over the political feasibility of the sectoral approaches, however. As previously mentioned, for example, the reality of how policies are implemented in China is almost entirely a local matter. In addition, despite some efforts by the central government to consolidate energy-intensive industries, competition among provinces, counties and cities to foster their own local champions and increase GDP, the capital stock, tax revenue and corporate profits has kept such industries' structures highly fragmented. Table 3.3 shows the fragmented nature of China's steel industry in terms of production, share and the number of firms. The top three firms contributed only 14% of national steel production in China as against 69% in Japan. Table 3.4 shows that there is an increasing evidence of fragmentation over time in several other industries, besides steel industry. Inter-province competition and highly fragmented structures of energy-intensive industries can be a burden for political efforts to set and implement common technology standards or intensity targets at sectoral level. One study argued that the poor performance of energy intensity improvement during the first year of the 11th Five Year Plan, which called for 20 percent reduction in energy intensity of GDP from 2005 to 2010, was largely due to local-interest-driven competition among provinces and cities (Rosen and Houser 2007).

The reality is that how policies are implemented in China is almost entirely a local matter.

Table 3.3 Global steel industry, market share and industrial concentration (2006)

Country	Production	Share	Top 3 firms*
	Crude, Mt	% of global	% of national
China	422	34.6	14.1
EU25	198	16.3	44.7
Japan	116	9.5	69.3
U.S.	99	8.1	59.7
Russia	71	5.8	55.1
South Korea	48	4.0	85.8
World	1,219	100	—

Source: Rosen and Houser 2007 Table 2, p. 13
Note: * Share of domestic production from the three largest companies in 2005.

Table 3.4 Industry concentration (number of firms in China)

Industry	2002*	2004	2006
Iron & steel	3,551	4,947	6,959
Nonferrous metals	1,332	1,766	2,798
Cement	4,656	5,042	5,210
Glass & glass product	1,739	2,205	2,982
Paper & pulp	2,606	3,009	3,388
Chemical material	12,481	15,172	20,083

Source: Rosen and Houser 2007 Table 3, p. 13.
Note: * 2002 number is from a February 2003 survey.

Arguments on political feasibility of proposals for building synergies between UNFCCC and non-UNFCCC initiatives are summarised in Table 3.5.

Table 3.5 Political feasibility of proposals for building synergies between UNFCCC and non-UNFCCC initiatives

Key Elements of Political Feasibility	Linking non-UNFCCC initiatives to the Kyoto Mechanisms	Sectoral approaches
Self-enforceability	✓	✓✓✓
Side-payments	✓✓	✓✓✓
Domestic interests	✓	✓✓
Domestic institutions	✓✓✓	✓

Legend: ✓✓✓addressed in depth ✓✓addressed in some detail ✓addressed very little

3.5.3 Assessment of proposals for enhancing the flexibility in Intellectual Property Rights (IPRs)

IPRs for low-carbon technologies was discussed prominently in IGES consultations, with participants from developing Asia seeking enhanced flexibility of IPRs.

The issue of IPRs for low-carbon technologies was discussed prominently in all IGES consultations, with participants from developing Asia seeking enhanced flexibility of IPRs. The joint ownership of IPRs through collaborative R&D may allow participating countries to share the costs of R&D and diversify risks associated with R&D. Joint R&D may also be seen as side-payments to those countries lacking technical, financial and human resources to develop the desired technologies on their own. However, self-enforceability of a joint R&D proposal is contingent upon whether the regulation and structure of the industry creates sufficient incentives to participate in and conduct joint research. India's experiences from IGCC showed that it was essential to provide economic incentives for the private sector to conduct research and deploy desired technologies through stricter regulations and pricing policies for carbon emissions (Ockwell et al. 2007). Furthermore, a joint cooperative R&D scheme for an industry with highly concentrated structure might decrease individual research incentives, thereby eliminating competition in technology development. Thus distinct decisions are necessary for making the collaborative R&D proposal more participation- and compliance-compatible.

Compulsory licensing of IPRs may be a unilateral action, but it is not automatically self-enforcing, since a country is not necessarily better off if it resorts to such measures. It is reported that aggressive use of compulsory licences as an instrument of technology transfer might eliminate prospects for effective technology transfer and discourage aggregate investments of foreign companies in the developing countries (Correa 2005). Furthermore, it was argued that the transfer of hardware through compulsory licensing does not compel the transfer of know-how and expertise necessary for generating and managing technical change, which many observers see as an indispensable element of effective technology transfer (Watson 2002). To avoid such negative consequences, policy-makers seeking compulsory licensing should consider the summation of social costs that may, in the end, outweigh short-term benefits of this action (Reichaman and Hasenzahl 2003).

Moreover, while advocates of compulsory licensing often draw an analogy with the case of HIV/AIDS vaccines, it should be noted that IPR protection generally plays a quite different role in the energy sector than it does in the pharmaceutical sector (Barton 2007a, Barton 2007b). In the pharmaceutical sector, an individual patent usually has a

substantial impact, since a specific drug may not have any substitutes. In contrast, in the energy sector, there is likely to be competition both within the general product area (e.g. wind turbines), and among different methods of producing electricity or fuel. For renewable energies such as photo-voltaic (PV), bio-mass and wind power, basic approaches to solving the specific technological problems have long been off-patent. Even for patented products, there is usually competition among different manufacturers, which brings royalties down. These conditions can reduce the thresholds to market entry, through methods other than resorting to compulsory licensing or buying-out. In the PV sector, for example, such possibility of entry was demonstrated by Tata-BP Solar, an Indian firm, based on a joint venture, and Suntech, a Chinese firm, based on a combination of its own technologies and purchase of developed world firms.

At the domestic level, however, compulsory licensing and buying-out approaches may be successful in deploying new technologies on a concessionary basis, as was demonstrated by the US Clean Air Act. The US Clean Air Act mandates the compulsory licensing of patented technologies needed to meet agreed standards. For example, in August 2006, a court in the US granted Toyota a compulsory license on three Paice patents for hybrid transmissions, for a royalty of USD 25 per automobile (Lee et al. 2007). On the other hand, the expertise and know-how, which are key factors of successful technology transfer, are unlikely to be associated with such a transfer. In addition, when a broad range of technology options is available, governments are likely to encounter difficulty in picking appropriate technologies especially due to the lack of information to negotiate a suitable price for royalties (Stern 2007). In this case, affected firms will lobby heavily, since they recognise the distributional implications of such measures. Concerns over who could get what may very well result in a serious political battle in the decision-making process.

In contrast to the compulsory licensing and buying-out approaches, the international collaborative R&D scheme may provide learning opportunities for participating companies, and access to technical and financial resources, especially to firms in developing countries. However, again, it is a matter of domestic institutional arrangements whether domestic companies can fully enjoy the fruit of international collaboration and deploy the desired technologies in developing countries. There are questions, for example, whether China's laws and regulations were adequate to cause the change in behaviours in the face of divisions of authority within China (Ohshita and Ortolano 2006, Cherni and Kentish 2007). Furthermore, weak domestic IPR protection in developing countries may deter domestic firms from participating in such international technology collaboration, as their domestic competitors may copy them without paying. It was reported that the risk of introducing clean coal technology in China would be very high since the acquired IPRs could not be effectively protected (Philibert and Podkanski 2005). The domestic institutional and administrative fragmentation needs to be addressed further.

IPRs may be only a partial barrier to technology transfer and diffusion; and the role of IPRs varies with industrial structures in question.

It must also be noted that IPR issues might be only a part of barriers to technology transfer and diffusion. The Stern Review pointed out that for key mitigation technologies, especially electricity generation, IPRs generally represented a much small component of cost due to the large scale of the capital investment and running costs (Stern 2007). A case study of an IGCC programme between India and the UK, furthermore, identified that the key barrier for IGCC use in India was not the IPRs per se but the lack of knowledge on whether IGCC could work with the low quality of Indian coal and the technology's lack of

a track record, and also that the economics did not favour IGCC over other technologies, unless there was an adequate restriction on CO_2 emission (Ockwell et al. 2007). IPR issues have not yet appear strongly even for CCS, as revealed from the work of task forces of the CSLF, in which China, India, Japan, and the Republic of Korea and 18 other countries participate. A study on the role of IPRs in access to renewable energy technologies in developing countries also showed that key barriers were not associated with IPRs and the role of IPRs varied along with industrial structures in question (Barton 2007a).

Arguments on political feasibility of proposals for enhancing the flexibility of IPRs are summarised in Table 3.6.

Table 3.6 Political feasibility of proposals for enhancing the flexibility in IPRs

Key Elements of Political Feasibility	Joint ownership of IPR through collaborative R&D	Buying-out and compulsory licensing
Self-enforceability	✓	✓
Side-payments	✓✓	✓
Domestic interests	✓	✓
Domestic institutions	✓	✓

Legend: ✓✓✓addressed in depth ✓✓addressed in some detail ✓addressed very little

3.6 The Way Forward

Each of the reviewed technology cooperation proposals has strengths and weaknesses in terms of the four elements of political feasibility – self-enforceability, the provision of side-payments, fit with domestic interests and institutional arrangements.

While the above consideration of political feasibility of technology cooperation proposals is preliminary and qualitative, it has some implications for discussions on the post-2012 climate regime. The assessment showed that each proposal has strengths and weaknesses in terms of the four elements of political feasibility – self-enforceability, the provision of side-payments, fit with domestic interests and domestic institutional arrangement. Proponents of each proposal need to consider such weaknesses and strengths.

The proposal of the global R&D has the advantage of being self-enforceable, but presents major donor countries with distributional or relative gains concerns at the international level. States care not only about their direct outcomes from cooperation but also how well they fare compared with others. Such concerns create zero-sum considerations that would impair international cooperation. One remedy is to offer side-payments such as preferential treatments of national companies of the major donor countries and a weighted voting system for the management of the fund. The former, however, might violate the principle of the World Trade Organisation. Another form of side-payments can be to link financial contributions with emissions reduction commitments, as proposed by the BASIC project (BASIC 2006). However, this form of side-payments is likely to erode environmental effectiveness, since financial contributions counted as emissions reduction commitments do not directly lead to net emissions reduction. Finally, it is also necessary to devise a mechanism to attract private funds for low-carbon technology finance. The creation of venture capital funds for nearly commercialised technologies, along with a global fund for basic R&D, may be one solution. The former is likely to find it easier to attract private investments, while the latter is basically financed by public money.

As for synergies between UNFCCC and non-UNFCCC initiatives, making project and/or programme activities with significant technology components under the UNFCCC eligible for preferential treatment under the CDM can take advantage of the existing domestic interests and institutional infrastructure in developing countries. Such synergies can be captured further by restructuring the CDM to specifically promote technology transfer. One proposal is Technology Transfer CDM, where a policy that promotes the adoption of a certain low-carbon technology within a single sector or across many sectors is made eligible for CDM (IGES 2005, Stern 2007). By approving CDM activities on the basis of an index of approved technologies, this approach is expected to streamline the CDM procedures and simultaneously boost the transfer of specific technologies. However, expanding the CDM scope will require deeper emissions cuts by developed countries and an effective enforcement mechanism. The Kyoto Protocol has not adequately addressed this fundamental problem. One approach to this enforcement problem is to seek solution not at the international level, but rather at the domestic level. For example, the British government introduced to Parliament a Climate Change Bill, which set ambitious emissions reduction targets. If it is passed, such domestic legal foundations help to alleviate the enforcement problem of international climate regime.

Most of the policy proposals do not adequately address the issue of domestic institutional and administrative fragmentation. Therefore negotiators who are designing the architecture of international technology cooperation need to be more cognisant of sub-national interests.

The issue of enhancing flexibility of IPRs provides a more complex political configuration, and requires further consideration. The ideas of buying-out and compulsory licensing with respect to mitigation technologies have been set forth and supported by several stakeholders from Asian countries, including China and India. However, economic results are not certain, and even if such ideas were put into practice, they might lose political support in the long run. It is perhaps critically important to assess each technology in each developing country to examine whether and how IPRs as a barrier to technology transfer might differ in importance depending on the stage of technology development or the nature of the technology itself (Stern 2007, Barton 2007a, Barton 2007b). The Expert Group on Technology Transfer, which was mandated to give its advice to both SBSTA and SBI at the recently held COP13 in Bali, may look into this issue more thoroughly.

International technology standards and a sector-based crediting mechanism for carbon intensity improvement have some merits on criteria of self-enforceability, side-payments and fit with domestic interests. International technology standards for tradable goods can be self-enforcing—i.e. if the number of actors adopting certain technology standards were to tip the balance so that network effects cause others to adopt the technology. The proposals also could match the organisational interests of implementing agencies like industry and energy ministries. In addition, these mechanisms can be designed with a view to building synergies with a quantitative national emissions reduction target framework for Annex 1 countries. A better understanding of relevant technology benchmarking can contribute to the development of a technology-based and bottom-up approach for differentiating national emissions targets. However, an important caveat comes from the domestic-level consideration of political feasibility. Domestic institutional and administrative fragmentation are likely to pose constraints to effective implementation in some Asian countries.

Lack of sufficient consideration of domestic institutional issues is not unique to the proposal for the sectoral crediting mechanism. Rather, what was revealed is that most of the policy proposals do not adequately address the issue of domestic institutional and

administrative fragmentation. This may be largely due to the nature of the proposals selected. However, domestic foundations are key to the effectiveness of any international cooperation. Without them, international cooperation, however carefully crafted, will be ineffective. To make international technology cooperation participation- and compliance-compatible, it is necessary to overcome such institutional fragmentation.

One of the ways forward is that negotiators who are designing the architecture of international technology cooperation need to be more cognisant of sub-national interests. Especially in large countries like China and India, more direct involvement of local governments and industries in the policymaking process during the crafting of a technology-oriented agreement is desirable. It may be wise to establish a coalition with key domestic actors who have an interest in international technology cooperation. Such actors may be motivated by economic benefits or their expectation to utilise international agreements for their own organisational objectives. From a national policymaker's perspective, in parallel, it is important to institutionalise the efforts of consulting local level policymakers before undertaking an international agreement, and to provide incentives and disincentives to get greater compliance of the agreement once it is made.[11] A number of policy tools are available at the hands of national leaders, including adjustments of fiscal transfers, promotions and demotions, and national campaigns to pressure local officials into compliance.

In this regard, there have been some developments in China. In parallel with a National Climate Change Programme (NCCP) in June 2007, which included several specific quantitative targets of mitigation policies, the State Council issued a notification that sought local governments to implement tangible policies and measures to achieve the objectives of the NCCP. The State Council also pronounced the establishment of the National Leading Group on Climate Change, Energy Efficiency and Pollutants Emissions Reduction, led by Chinese Premier Wen Jiabao and consisting of top officials from 23 ministries and agencies. Such ideas and norms that originated within the Chinese leadership ranks would send a clear signal to local governments regarding the types of policies acceptable to leaders (Tanner 1995). The establishment of similar inter-agency bodies for tackling climate change issues headed by Prime Ministers or Presidents is now observed in other Asian developing countries including India, Pakistan and Viet Nam.

The domestic incentive and disincentive mechanisms will vary cross-nationally. Therefore, there is a need to study how such arrangements are implemented at the domestic level in different Asian countries.

The domestic incentive and disincentive mechanisms to facilitate the effectiveness of participation and compliance will vary cross-nationally to some extent. Therefore, there is a need to conduct empirical studies on how such arrangements are implemented at the domestic level in Asian countries. There is also a need for interdisciplinary research in Asia to look into issues such as how an effective technology-oriented agreement can be transformed into an environmentally effective technology transfer agreement. A better understanding of the political feasibility is an asset in the design of international technology agreements in the post-2012 climate regime.

11. Asian developing countries are by no means unique to the problem of domestic institutions. Other developing countries as well as developed countries also face similar problems, when they negotiate and comply with international commitments. For the case of the U.S. in international climate policy, for example, see Tamura (2006a).

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