Chapter 9

Low Carbon Technology Transfer in the Context of Asian Regional Integration

Rabhi Abdessalem

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Key Messages

- Despite broad acknowledgement of the importance of low-carbon technologies transfer and application (LCTT) for sustainable development in Asia, efforts made to date to promote LCTT to and within the region remain somewhat fragmented and weakly uncoordinated.
- Creating and strengthening cooperation initiatives among Asian countries will be necessary to promote LCTT, rather than expecting such promotion to occur naturally as a by-product of greater economic integration and market forces.
- To promote LCTT, the chapter proposes to address LCTT process as a process that is composed of three complementary steps: (i) identification of needs and availability, (ii) matching and testing, and (iii) upscaling and diffusion. Creating and strengthening cooperation initiatives among Asian countries is required at each of those three steps.
- Regional integration can stimulate the transfer of low-carbon technologies, but real determination is needed for effective facilitation.
- This chapter recommends (i) establishing a regional platform for information sharing and matchmaking, (ii) developing a regional low-carbon technology roadmap, (iii) conducting awareness raising and capacity building in key economic sectors, including for small and medium-sized enterprises, and (iv) providing tax benefits and other economic incentives to stimulate demand for low-carbon technologies.

1. Introduction

Promoting the transfer and application of low carbon technologies (LCTT) has been recognised as one of several key factors to achieving sustainable development. In Asia, various initiatives and measures have been taken so far at unilateral, bilateral, and multilateral levels to promote LCTT to and within the region; however, results have fallen short of expectations compared to the efforts and resources dedicated to such. This chapter reviews the current status and provides pointers for a more effective and comprehensive strategy to promote LCTT to, and within the region.

The chapter focuses on outlining a regional framework to promote LCTT, and how such a framework could be formulated in the context of regional integration. It points out that despite the current trend in regional integration within Asian, initiatives regarding LCTT remain somewhat fragmented and weakly coordinated. In particular, it highlights that information on the technologies that exist (hereafter "seeds") or are in demand (hereafter "needs") is often lacking or scattered. In addition, the extent of actual matching such seeds with needs is lacking. Much effort has been extolled to stimulate trade and Foreign Direct Investment (FDI) through regional economic integration, but this alone is insufficient for promoting LCTT.

The chapter argues that advancing regional economic integration, with increasing trade and FDI, will not necessarily also stimulate LCTT. In order for regional integration processes to play such a role they need to establish specific LCTT facilitation mechanisms to address issues related to each stage of the LCTT process. The chapter introduces a three-stage model of the LCTT process and provides recommendations on what should be done at each stage.

The remainder of the chapter is arranged as follows. The second section outlines the importance of promoting LCTT to the world in general and to Asia in particular; the third section highlights key factors behind the shortfall in promoting LCTT in Asia; the fourth section provides pointers on how to rectify such factors; and the fifth section provides a summary and conclusion.

2. Low Carbon Technology Transfer: Key to Asian sustainable development

2.1 Importance of LCTT for the world and Asia

Promoting LCTT is widely considered a key means by which to reduce GHG emissions and contribute to climate change mitigation. At the global level for example, according to an International Energy Agency report ("Energy Technology Perspective"), if governments worldwide introduce no new energy and climate policies, energy-related CO_2 emissions will surge from 28.8 gigatonnes (Gt) in 2007 to 34.5 in 2020, and may top 57 by 2050. In contrast, through deployment and diffusion of existing and new low carbon technologies, this figure could be suppressed to about 14 Gt by 2050 (IEA 2010).

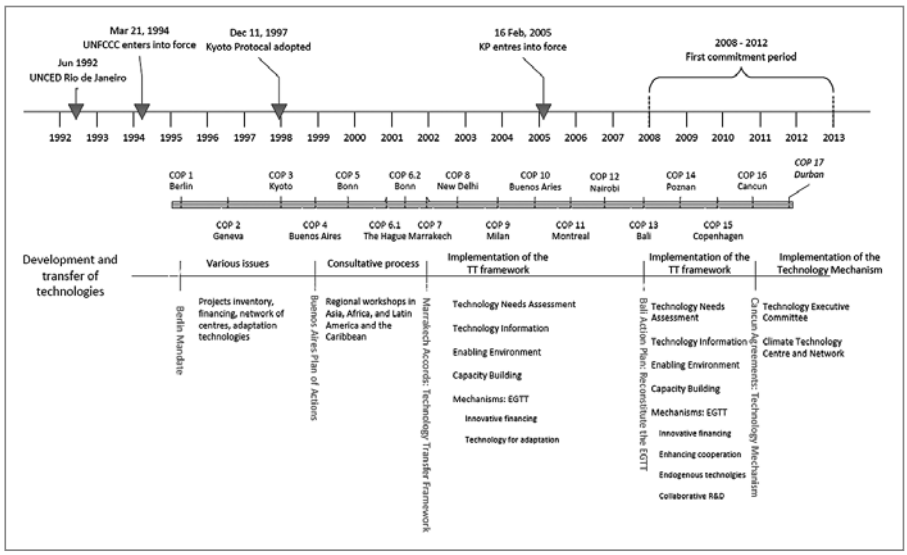
At the Asian region level, CO_2 emissions reduction potential is estimated to be around 6.8 billion tonnes, based on the Technologically Advanced Scenario.[1] This amount accounts for 55% of the world's total reduction potential, indicating the huge impact Asia could have if low carbon technology transfer (Ryoichi Komiyama 2010) were instigated. Energy saving-related technologies could contribute about 53% to this reduction, fuel switching 31% and Carbon Dioxide Capture and Storage (CCS) 16%. A 3.6 billion-tonne mitigation through energy saving-related technologies in Asia until 2035 would contribute to one-third of total global CO_2 reduction.

At the subregional level, low carbon technologies are projected to boost CO_2 emission reduction in the ASEAN region. According to Ölz and Beerepoot (2010), energy saving and renewable energy technologies could contribute respectively to 319 and 121 Mt CO_2 reductions by 2030 in the ASEAN region. The same study also shows that low carbon technologies are projected to cover 36% of energy demand across Southeast Asia, the most notable of which are solar, wind and geothermal which together could satisfy almost 11% of regional energy demand by 2030.

LCCT will not only contribute to CO_2 emission reduction in Asia but also result in co-benefits in terms of energy security, human health and environmental protection. Further, numerous low carbon technologies offer real economic returns and short payback periods, and can contribute substantially to the economic development of emerging countries (ADB and ADBI 2013). Last but not the least, a regionally coordinated flow of low carbon technology, implemented as quickly and widely as possible, was found to lower GHG mitigation costs of emerging economies; hence, enhancing regional cooperation among Asian countries to promote LCCT should be considered in order to lower GHG mitigation cost in the region.

2.2 Technology transfer: still an urgent topic

The key role of technology transfer in tackling climate change has been acknowledged since the creation of the United Nation Framework Convention on Climate Change (UNFCCC) in 1994, iterated at each session of the Conference of the Parties (COP), and resulted in some developmental progress, but is still considered a hot topic and an urgent challenge (Figure 9.1).



Source: Technology Executive Committee (2011)

Figure 9.1 Discussion on development and transfer of technologies under the UNFCCC process

The continued focus on LCTT is due to the fact that although numerous discussions have taken place on the topic at national, regional and international levels, no consensus has been reached on who, what and how as regards LCTT promotion. The lack of broad consensus is understandable given that LCTT is a complex process and involves a wide variety of stakeholders; however, it could also be related to the fragmental nature of the discussions, which tend to focus merely on particular aspects rather than the big picture, which means that any recommendations or conclusions provided lack comprehensive scope, despite their relevance.

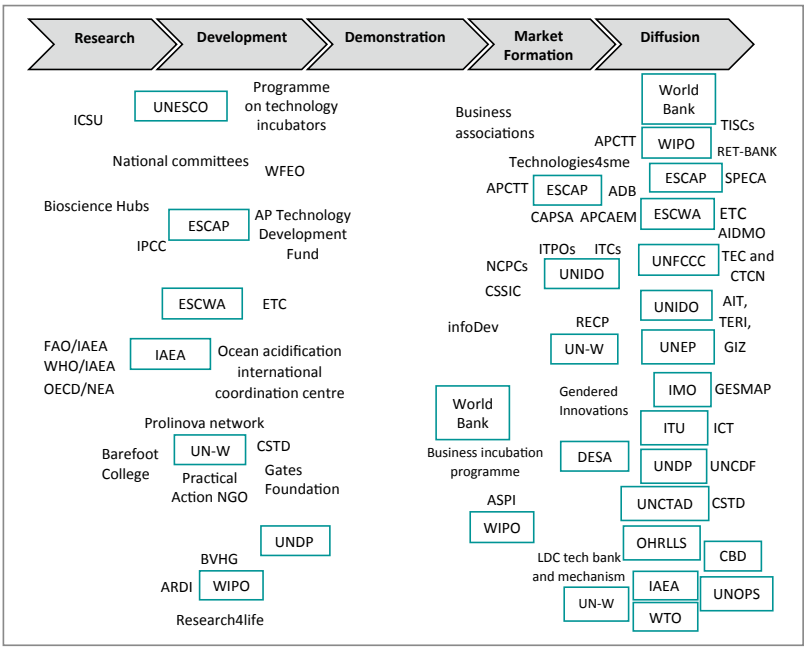
In the Asian context, the issue of technology transfer has been addressed in most recent agreements in the region, such as Asia Pacific Economic Cooperation (APEC),

Comprehensive Economic Partnership in East Asia (EPEA), Asia Pacific Partnership (APP). The importance of LCTT has been discussed intensively at high level events such as the Singapore Declaration on Climate Change, Energy and the Environment, and the East Asia Low Carbon Growth Partnership Dialogue. For instance, the Singapore Declaration states that "actions would be taken in encouraging the deployment of clean technology in the region through various means, such as investment, technical and financial assistance, technology transfer,...". The importance of technology transfer was also recognised during the second East Asia Low Carbon Growth Partnership Dialogue, held in Japan in April 2014. The main theme of the Dialogue—as a result of the prime ministerial instruction "to formulate a proactive diplomatic strategy to address global warming by which Japan contributes to the international community with its technology"—was technology.

3. Status of LCTT in Asia

3.1 Fragmented, uncoordinated initiatives

Various stakeholders in Asia are making significant efforts to promote LCTT and a large number of partnerships, programmes, projects and instruments in the region are managed by United Nation organisations (Figure 9.2). However, no regional framework, agreement, assessment or monitoring mechanism currently exists to bind them all together, which means they are becoming ever more fragmented and uncoordinated in terms of objective, content and country coverage. Most of them only focus on specific sectors or particular regions and involve major overlaps, with most contributions focusing on either research and development or transition from market formation to diffusion.



Source: Author (based on UN Secretary General report A/67/348 (2012))

Figure 9.2 Overview of United Nations contributions (boxes) and selected partnerships (without boxes)[2]

In the absence of an effective coordination mechanism, addressing all the stages of technology transfer and coordinating between such initiatives is a challenging task. Hence, a regional technology facilitation mechanism that builds on this work and reaps synergy through networking and partnerships is urgently required.

3.2 Lack of information on 'seeds' and 'needs'

In terms of manufacturing and export of low carbon technology, several developing countries in Asia have become world leaders, and some are also emerging as key users. South-South clean technology transfer is also increasingly becoming more important. Hence, the availability of information on what technologies exist on the supply side (hereafter 'seeds') and which technologies are needed on the demand side (hereafter 'needs') is crucial to kick-off the matchmaking process between seeds and needs. For most countries in Asia, comprehensive databases on seeds and needs do not exist, or are difficult to access or scattered among institutions. Most of the focus hasn't been on creating and sharing such information (i.e., through development of Technology Need Assessment (TNA) and Technology Availability Assessment (TAA)), and instead has centred on crafting policies related to market transformation to absorb available technologies. Although TNAs exist for some countries they are not updated regularly, and for most countries TAA and TNA still await development.[3]

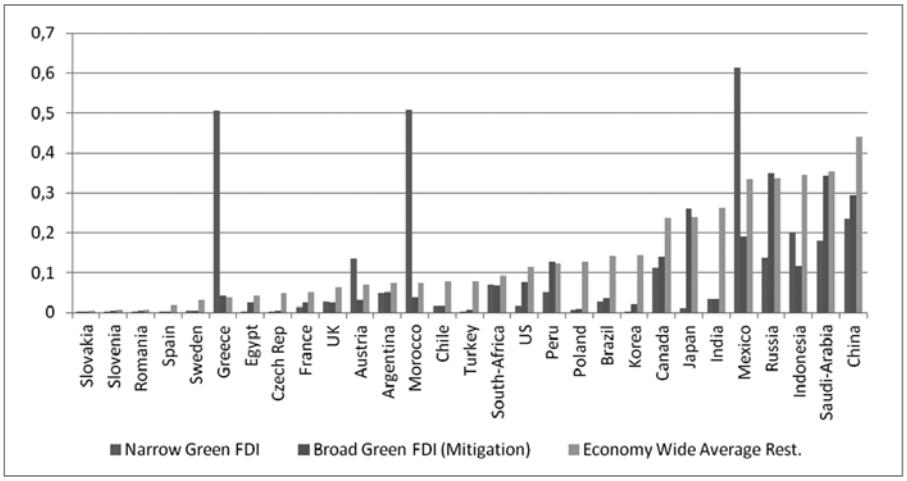
3.3 Little action on pilot/demonstration projects

As depicted in Figure 9.2 above, most initiatives in the region focus on either research and development or transition from market formation to diffusion, rather than on demonstration or linking demonstration with market formation. In addition, significant efforts and resources have been allocated to conduct feasibility studies (FSs) on the application of technology to specific conditions, whereas little action is taken to follow-up on such FSs. For instance, in 2012 a total of 60 FSs in the field of electricity generation, forest conservation, transportation and waste management were conducted in East Asia by Global Environmental Facility (GEF); In 2013, about JPY 7.6 billion (USD 76 million) was earmarked for model projects in addition to FSs in the same region[4]; Japan is the current leader in number of FSs under the Joint Crediting Mechanism (JCM) scheme, where more than 165 have been conducted by governmental agencies through the Global Environmental Centre foundation (GEC), Japan International Cooperation Agency (JICA), and others.[5] However, only a few projects have actually been implemented on the ground.

3.4 Significant barriers still exist to using trade and FDI to promote LCTT

Trade and FDI are widely acknowledged as key channels for technology transfer (Schneider et al. 2008; World Bank 2008). However, trade and FDI flows in Asia are uneven across sectors and regions. For example, while trade between India and China is growing, this process does not involve all regions or all sectors of South Asia. At the same time, the intra-subregional trade share among members of the South Asian Association for Regional Cooperation (SAARC) is less than 6%.

Although numerous free trade agreements (FTAs) have been concluded in the region to accelerate the flow of trade and FDI, their impacts have been limited and are viewed as "trade light". The level of restrictions by major economies in Asia remains high compared to USA and other countries in Europe (Figure 9.3). FTAs have been largely limited to tariff cuts and only tackle non-tariff regulatory barriers to a low extent. They are also bedevilled by differing rule of origin (ROOs) within and between agreements, causing confusion and added administrative costs for businesses (Sally 2010).



Source: Golub, S. S. et al (2011).
(Note: Y axis shows the level of restriction, ranging from 0.0 to 1.0, where 0.0 refers to fully opened and 1.0 to fully closed)

Figure 9.3 Severity of restrictions on economy in general and on green FDI in particular, by country

Current efforts to tap the potential of using trade and FDI to promote LCTT in the region appear lacking. For liberalisation of trade and FDI to effectively promote LCTT, it needs to provide preferential treatment to low carbon technologies compared to other "brown" technologies, such as the case of the agreement reached in 2012 among participating countries in the Asia-Pacific Economic Cooperation Forum (APEC). The countries agreed on a list of 54 environmental goods for which import tariffs would be reduced to 5% or less by 2015. Initiatives to provide preferential treatment to green and low carbon technologies remain limited in the region.

Furthermore, even if trade and FDI agreements are crafted to provide preferential treatment to LCTT, there is still scope to do more to address the last stage of LCTT, namely deployment and diffusion. Thus, trade and FDI policies themselves could be helpful, but are insufficient in promoting technology transfer in general and LCTT in particular. This chapter argues that to promote LCTT, all stages of the LCTT process should be addressed in a cooperative and coordinated manner. More details about such stages and what could be done in each of them are given in the following section.

4. Aspects of strategy

Against the above background, and as part of a strategy to promote LCTT to and within Asia, the chapter proposes a 3-stage LCTT process, identifies key issues related to each stage, and provides pointers on how to rectify such issues. The overall focus is to explore how the inter-stakeholder cooperation framework can be modified to address each stage of the LCTT process in a synergistic manner, instead of simply waiting for integration in general to work its course and promote LCTT through market forces.

4.1 LCTT as a three-stage process

As depicted in Figure 9.2 above, the technology cycle follows a well-known path through different stages from research to development, demonstration, market formation, and

eventual diffusion in the market place, in which technology could be transferred from the supply to the demand side at any stage. In addition, the current thinking regarding the LCTT process comprises mainly a traditional supply-side focus, which often doesn't match the needs of buyers. In order to provide a foundation for a strategy, this chapter proposes to rethink the technology transfer process as a process of matchmaking, composed of three stages: The first stage consists of identifying 'seeds' (technology available on the provider side) and 'needs' (that needed on the recipient side). This involves coordination among various stakeholders from both supply and demand sides in order to identify the technologies which are available on the supply side and needed on the demand side, and which are transferable and applicable to local contexts. The second stage consists of matching the seeds with the needs, and involves cooperation among various stakeholders, on both the supply and demand side, to conduct joint actions to actually perform the transfer and apply the technology in the recipient country (possibly at the site level) through feasibility studies, demonstration cases (pilot projects), impact assessments, awareness creation and capacity building, for example. The third stage consists of scaling-up the matching process of seeds and needs to diffuse the technology more widely in recipient countries (cluster, sector, or nationwide) and involves creating an enabling environment to enhance the diffusion of the technology through conventional channels, especially FDI and trade. This process of technology transfer is schematically shown in Figure 9.4 below, although the overall process is, of course, much more complex and much less mechanistic than that shown.

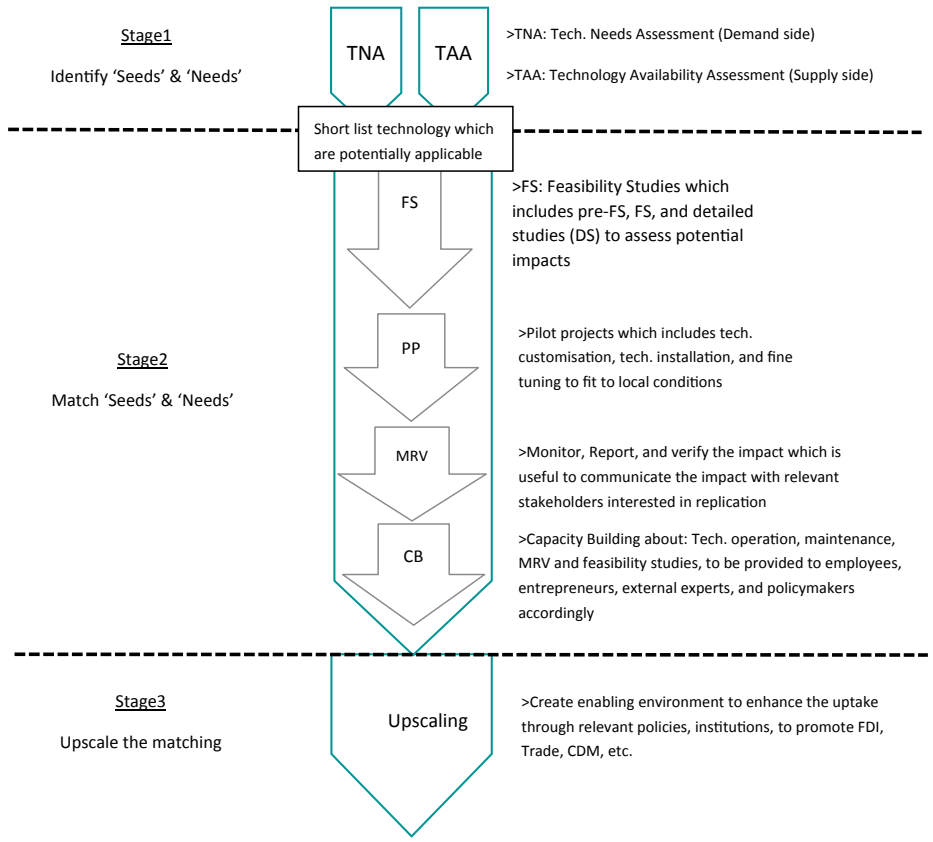


Figure 9.4 Technology transfer process as viewed in this chapter[6]

The following discussion traces the structure of the proposed LCCT processes and highlights several issues related to each stage of the process.

4.1.1 Stage 1: Identification of 'seeds' and 'needs'

Information on technologies related to the seeds and needs is not always available. Crucial starting points in the promotion of LCTT are considered to be the sequencing and prioritisation of low carbon technologies at the sector and economy levels (from the perspective of transferor and transferee) through conducting a technology needs assessment (TNA) and technology availability assessment (TAA). Thus, TNA and TAA are both crucial in terms of time and effort in order to initiate matching seeds with needs.

Nevertheless, TNA and TAA availability represent just one initial step, as some technologies could be identified as available in TAA as well as identified as needed in TNA but not actually be transferable and applicable to local conditions due to technical, environmental, social, financial, or other reasons. Hence, after developing the TNA and TAA, the potential for LCTT between each pair of countries needs to be analysed, which produces a shorter list of technologies that are not only available and needed but also potentially applicable in the recipient country concerned. Furthermore, given that technology transfer is a dynamic process—as are the conditions surrounding such—the identified shortlist of technologies should be updated often, and shortened further if possible, based on ongoing analysis of the conditions through feasibility studies and detailed studies.

Identification of seeds and needs should not be limited to merely arriving at a shortlist of potentially transferable technologies; it should also include identification of the surrounding conditions affecting the transfer of such technologies in terms of identifying and analysing the opportunities and risks relating to the transfer, preferences from businesses and government perspectives, carbon emission potential, and so on. Also, it should include the identification, collection, analysis, documentation, and dissemination of motivations for their transfer, in terms of investment potential, related policies, regulations, incentives, standards and so on.

From the above, a map of identified technologies and surrounding conditions could be developed, the information of which could be shared and made accessible to all stakeholders. Information sharing could be also coupled with knowledge building by developing a matrix that illustrates the potential for matchmaking (technology to geographic location; technology to incentives/regulations; stakeholder to stakeholder, etc.). The outputs (technology map and matrix) could form the input for a national public database or through an online knowledge platform that all relevant stakeholders, at national, regional and international levels, could access. This would represent a crucial step forwards in matching seeds with needs.

Mobilising funds from the private sector to create and share such information may be difficult, however. Individual companies are focused on selling their own technologies, which may or may not be the best match for specific users, while providing matchmaking services might not be profitable enough to be provided by a private company. Therefore, the necessary financial resources may need to come from the public sector, with the NGO sector providing technical support.

4.1.2 Stage 2: Matching seeds with needs

Some low carbon technologies are applicable to all countries and under any conditions, but others, although at the commercialisation stage on the supply country side, may

require more work to match them with local conditions in the recipient country. It is the latter group of new-to-the-market or new-to-the-firm technologies that are addressed in this subsection. Matching such technologies to local conditions requires conducting feasibility studies to identify to what extent they need to be modified. Feasibility studies need to be followed by demonstration projects as well as impact assessments and capacity building in order to accurately assess whether matching is possible or not. For instance, although feasibility studies (FS) and detailed studies (DS) can be conducted at the site level, and although technologies can be customised for local conditions based on such FS/DS, the results on the ground starting from pilot project implementation could differ from expectations. In addition, although technologies can be customised for local conditions, further intervention may be necessary after implementing the pilot projects, for fine tuning, adjustment and 'hand holding' to deal with conditions that could not be anticipated, which may affect the results estimated during FS studies. Furthermore, external factors such as the price of energy could fluctuate significantly between the time of FS/DS and post-pilot project implementation[7]. Thus, a project which has been identified as economically feasible before actual implementation may become exceedingly costly afterwards. This means that pilot project implementation is of crucial importance as it reveals actual impacts of applying technologies rather than making decisions based solely on feasibility studies.

Monitoring, reporting and verification (MRV) of the impacts of implementing a technology in a recipient country are also vital as they evaluate the benefits and co-benefits of the implemented technology. This in turn will be vital when communicating the findings to the relevant stakeholders, such as government organisations, financial institutions, business associations, and engaging them in the diffusion process. MRV activities should be conducted for a sufficient period of time, before and after pilot project implementation. The results from MRV activities should be documented, soundly analysed and easy to explain. For instance, MRV issues have been overlooked in most FSs and pilot projects implemented under Official Development Assistance (ODA) projects, which raises questions about the efficacy of these activities when promoting LCTT on a larger scale.

Matching seeds with needs also includes building the recipient's capacity in terms of operation, maintenance, trouble-shooting of the provided technology. In its report, Asian Development Bank (ADB) argues that without developing the capacity to absorb and use the transferred knowledge, the returns on technology transfer are likely to be limited (ADB and ADBI 2012). Capacity could be developed through direct interaction with end users by providing onsite training. It should also be provided to other experts and professionals as regards concepts, functioning, and especially how to conduct feasibility studies and assess the impacts of the provided technology. This could be done via 'training of trainers' (ToT) programmes and provision of materials and toolkits, preferably in the native language.

Hence, matching seeds with needs is not limited to matching technology to local conditions, and also embraces matchmaking involving related stakeholders in the region, especially those of the Business to Policymakers (B2P) and Business to Business (B2B) nature. At this stage, it may be still difficult to mobilise funds from the private sector to facilitate such matching, so the financial resources to conduct such activities would need to be secured from the public sector or via a public-private partnership programme, with technical expertise from the private sector. Research institutions, NGOs/NPOs, and so on could be assigned as intermediaries to facilitate this stakeholder matchmaking.

4.1.3 Stage 3: Technology up-scaling and replication

Creating an enabling environment to enhance trade and FDI is a key measure to scale up technology transfer, as they are both widely recognised as the main channels for technology transfer (Schneider et al. 2008). The World Bank reports that dismantling trade barriers in many developing countries over the past two decades has dramatically increased developing country exposure to foreign technologies, and that the easing of restrictions on FDI also has contributed to technology diffusion within developing countries (World Bank 2008). Economic and Social Commission for Asia and the Pacific (ESCAP) argues that trade and investment can contribute to mitigation of GHG emissions if producers switch from using fossil fuel-based technologies to climate smart technologies (CSTs), particularly renewable energy technology (RETs) (ESCAP 2011). FDI should be coupled with complementary measures such as streamlined green governance at company and government levels to attract low carbon FDI (Rabhi and Shiga 2012).

Creating the enabling environment for trade and FDI could include creating a supportive institutional infrastructure as well as introducing investment policies that respond to specific needs and situations, such as by strengthening intellectual property rights (IPR), tax holidays, tariff adjustments, industry parks, making markets more transparent, to stimulate markets for low carbon technology transfer. Policymakers could also reduce or eliminate subsidies for fossil fuels as well as include environmental costs in the overall price of energy services to make low carbon technology financially and economically attractive. Furthermore, policymakers could develop product standards, instituting industry codes and certification procedures that favour low carbon technologies and could also introduce and showcase low carbon technologies in state-owned companies, through public procurement, which would provide a model for the private sector to follow.

Trade and FDI policies can lead to more widespread adoption of technologies; however, they do not differentiate between low carbon and other technologies and therefore may not create favorable conditions for the former in particular. For trade and FDI policies to promote the transfer and diffusion of low carbon technologies they need to provide preferential treatment of such technologies. For example, the level of technology standards, tariff reduction, IPR, incentives for attracting FDI, etc. could be crafted to be proportional to the level of GHG emission reduction potential of the transferred technology. This could limit the flow of 'brown' technologies and the entry or relocation of businesses searching for 'pollution heaven'.

Creation of an enabling environment to enhance trade and FDI is not only the role of policymakers. It also requires the involvement of various intermediaries such as research institutes, business associations, chambers of commerce, civil society, regional and international organisations and academia, who could enhance the enabling environment through their activities and capacity of matching related stakeholders, especially in the business to business (B2B), business to funding institutions (B2F), and business to policymaker (B2P) realms.

For instance, various national policies could be in place to promote trade and FDI and to promote LCTT in general; however, businesses, especially SMEs, funding institutions and civil society might not be aware of these policies. In addition, various stakeholders are working on the promotion of low carbon technologies and their work often overlaps. Creating a matchmaking process to enhance synergy among the related stakeholders, from supply and demand sides, is therefore crucial.

4.2 Creating and strengthening cooperation initiatives among stakeholders

Countries in Asia are slowly but surely taking steps towards the deeper and more strongly coordinated cooperation necessary to promote LCTT, to and within the region. Establishment of new subregional and regional institutions as well as consolidation and strengthening of existing ones are perhaps the first steps toward creating more effective institutions to support LCTT. The next logical step will be to link these institutions to tap existing synergies and to explore other potential areas of cooperation. Creating and strengthening cooperation initiatives will be necessary at each stage of LCTT explained above. This could be facilitated through the establishment of a regional technology innovation system focused on each step and that seamlessly bridges the significant gaps existing between the stages. More details covering what could be done at each stage are given below.

4.2.1 Creating and strengthening cooperation initiatives to identify seeds and needs

Each country in Asia should conduct country reviews and profiles to identify, collect, analyse, document, and disseminate their needs as well as availability in terms of technologies, best practices, resources, and so on related to low carbon technologies. They should also do the same for low carbon technology investment potentials, related regulations, incentives, standards, and so on that will reduce GHG emissions. Patent protection and intellectual property rights also need considering. Creating national, public databases at the country level to make all of this information accessible through an online knowledge platform system would foster dissemination. To do this, development of national information systems for mapping available and needed technologies, as well as coordination units among relevant stakeholders (i.e., focal points) should be put in place.

Naturally, not all countries in Asia are able to carry out all the above on their own, so creating and strengthening cooperation initiatives among several countries on bilateral and multilateral bases could be considered. Assistance in this regards could be provided from relevant regional and international institutions among those given in Figure 9.2 above. Once the seeds and needs are identified by each country in Asia, coordination among countries at the bilateral or multilateral level should be carried out to identify gaps, priority areas, partners, solutions (open-source or commercial), and so on. This could be done through involving relevant intermediaries from national, regional and even international levels, who would facilitate the coordination processes between countries to identify the gaps. Intermediaries, such as research institutes, civil society, NGOs/NPOs, could develop a matrix of long lists of identified seeds and needs and then merge them and narrow them down to develop a shortlist of technologies potentially applicable in recipient countries and prioritised from the perspective of supply and demand. Developing a regional information system for mapping technologies available and needed as well as establishment of an online regional knowledge platform could be considered. To this end, financial support from the public sector as well as regional and international organisations such as UNEP, ADB could be considered. Stakeholders could coordinate their efforts through regional and sub-regional coordination mechanisms.

4.2.2 Creating and strengthening cooperation initiatives to match seeds with needs

Cooperation within Asia is needed especially regarding technologies new to the market and new within recipient countries. To this end, promoting partnerships among related stakeholders in the region, including government organisations, research institutes, NGOs/NPOs, academia and especially the private sector, has to be considered. Under

such partnerships, each stakeholder could play a specific role. For example, financial support could be provided by governmental agencies, technical support from the private sector, and other consultancy and facilitating of the matchmaking processes could be provided by research institutes, NGOs/NPOs and so on.

Engaging experts and businesses from the supply side to conduct FS, capacity building, monitoring, etc. is crucial, which could be done through a resource pool of experts from partner institutions. Conducting pilot projects under specific national, regional or subregional initiatives would identify how to customise and adapt technologies and good practices, and here an intergovernmental mechanism could be established for impact assessment of new technologies. Again, regional and sub-regional cooperation mechanisms could be formed to facilitate the matchmaking process among related stakeholders.

Intra-Asia coordination at this stage could also include mutual outreach and awareness activities—especially for the end users—involving regional peer learning, exchanges, and training programmes. Establishment of inter-governmental or expert dialogues in specific sectors, including bilateral and regional cooperation, as well as a regional information system for mapping successful case studies of cooperation, pilot projects, advice, consultation and so on would also be useful. Some of the measures could be supported or handled by regional or international initiatives, such as under Climate Technology Centre and Network (CTCN), the Climate Technology Network and Finance (CTNF) programme, or the ADB assisted broker model.

Cooperation among Asian countries could also include agreements to create favorable conditions for low carbon technologies in general, and especially for those which are new to market, such as through lowered import taxes or even tax exemption for the latter.

4.2.3 Creating and strengthening cooperation initiatives to scale up the matching process

Strengthening cooperation initiatives within Asia's countries by creating a supportive institutional infrastructure and introducing investment policies that respond to specific needs and contexts could stimulate markets for LCTT. Such could be brought about through establishing basic climate change policies covering regulation, taxation and subsidisation by strengthening IPR, tax holidays, tariff adjustments, cap and trade, industry parks, improved market transparency and so on. Governments within Asia could reduce or eliminate subsidies for fossil fuels, add environmental costs to the overall price of energy services, and introduce low carbon technologies in state-owned companies through public procurement mechanisms. Furthermore, policymakers in the region could develop product standards, industry codes and certification procedures favourable for low carbon technologies. Enhanced trade and production integration throughout the countries in Asia would increase the flow of trade and FDI, and could be directed to ensure low carbon technologies are given preferential treatment over the dirty 'brown' technologies.

Further, national policies of the region could be combined to increase coherence and focus on (i) creating the enabling policy and business environments to enhance the replication of technologies and good practices; (ii) dissemination of research results and lessons learnt; (iii) creating an inventory of technology clearing-houses; (iv) facilitating intergovernmental or expert fora/dialogues; (v) considering technology transfer in the context of publicly-funded technologies and public procurement, on concessional and preferential terms. The provision of small loans and grants, including concessional loans and risk-capital grants could be also considered.

Other recommendations include (i) promoting partnerships with various intermediaries, (especially the private sector) through joint ventures and FDI in line with developing country priorities; (ii) providing funding through small loans, grants programmes, technology prizes, etc. (iii) establishing a market place for low carbon technologies and catalyse more investment from public and private sectors. This can include establishing a low carbon matching platform linking potential technology sellers and buyers.

The following initiatives could be considered as well: (i) a regional clean technology venture capital fund (risk capital fund); (ii) regional technology centres such as under ESCWA and ESCAP; (iii) economic partnership agreements on green technology transfer and deployment (including sustainable energy trade agreements); and (iv) a regional network of centres of excellence, partnerships and hubs related to low carbon technology transfer.

Many of these recommendations are not necessarily new. However, their adoption in the region has been limited, so it is worthwhile emphasising them in the course of examining more recent trends towards further economic integration.

5. Conclusion

Despite broad acknowledgement of the importance of LCTT for sustainable development in Asia, measures taken to date to promote LCTT to and within the region have fallen short of expectations.

Efforts to improve on this situation are currently fragmented and largely uncoordinated. Ongoing economic integration had the potential to facilitate LCTT; however, its influence has been limited due to the ongoing challenges related to non-tariff regulation, ROOs, as well as insufficient preferential treatment to LCTT over more traditional and more polluting technologies.

The chapter argues that addressing the issues related to non-tariff regulations, ROO, and crafting FDI policies in a manner to provide preferential treatment to LCTT in the region are necessary measures but still will not be sufficient. More efforts will be needed to address the last stage of LCTT, namely upscaling.

The chapter points out the need to promote LCTT by addressing all three stages, and it calls for creating and strengthening cooperation initiatives among Asian countries for each stage. Such cooperation initiatives should be created to first identify the seeds and needs, then to facilitate the matching of seeds and needs, with special emphasis on demonstration and pilot project implementation (small scale), and finally to scale-up the matching over a broader area. Such matching should not be limited to simply finding the right technology to suit local conditions but should also include ensuring the relevant stakeholders are matched, on both the supply and demand sides.

Creating and strengthening cooperation initiatives among Asian countries will be necessary to promote LCTT, rather than expecting such promotion to occur naturally as a by-product of greater economic integration and market forces. Creating and strengthening such cooperation initiatives is not only the role of policymakers—it also requires the involvement of various intermediaries such as research institutes, business associations, chambers of commerce, civil society, regional and international organisations and academia, who are already engaged in this field, to tap existing synergies as well as to explore other potential areas of cooperation.

Notes

1. Technologically Advanced Scenario analyses how global energy demand and supply could evolve if countries adopted all policies currently on the table related to energy security, CO_2 emissions and technology transfer, and advanced technology widely deployed globally (Komiyama 2010).
2. Abbreviations in Figure 2:
   ADB, Asian Development Bank; AIT, Asian Institute of Technology; AP, Asia-Pacific; APCAEM, United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery; APCTT, Asian and Pacific Centre for Transfer of Technology; ARDI, Access to Research for Development and Innovation programme; ASPI, Access to Specialized Patent Information programme; BVHG, BIO Ventures for Global Health; CAPSA, Centre for Alleviation of Poverty through Sustainable Agriculture; CBD, Convention on Biological Diversity; CSSIC, Centres for South-South Industrial Cooperation; CSTD, Commission on Science and Technology for Development; CTCN, Climate Technology Centre and Network of the Framework Convention; DESA, Department of Economic and Social Affairs; ESCAP, Economic and Social Commission for Asia and the Pacific; ESCWA, Economic and Social Commission for Western Asia; ETC, Technology Centre of the Economic and Social Commission for Western Asia; FAO, Food and Agriculture Organization of the United Nations; Gates Foundation, Bill and Melinda Gates Foundation; GESAMP, Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection; GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit; IAEA, International Atomic Energy Agency; ICSU, International Council for Science; IMO, International Maritime Organization; infoDev, infoDev programme of the World Bank; IPCC, Intergovernmental Panel on Climate Change; ITCs, international technology centres; ITPOs, investment and technology promotion offices; ITU, International Telecommunication Union; LDC tech bank and mechanism: technology bank and mechanism for the least developed countries; NCPCs, national cleaner production centres; NGO, non-governmental organization; OECD-NEA, Nuclear Energy Agency of the Organization for Economic Cooperation and Development; OHRLLS, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States; RECP, network for resource efficiency and cleaner production; RET-Bank, renewable energy technology bank of the Asian and Pacific Centre for Transfer of Technology; SPECA, United Nations Special Programme for the Economies of Central Asia; ; Technology4sme, web-based technology transfer facilitation mechanism of the Asian and Pacific Centre for Transfer of Technology (Technology4sme.net); TERI, the Energy and Resources Institute (India); TISCs, technology and innovation support centres; UNCDF, United Nations Capital Development Fund; UNCTAD, United Nations Conference on Trade and Development; UNDP, United Nations Development Programme; UNEP, United Nations Environment Programme; UNESCO, United Nations Educational, Scientific and Cultural Organization; UNFCCC, United Nations Framework Convention on Climate Change; UNIDO, United Nations Industrial Development Organization; UNOPS, United Nations Office for Project Services; UN-W, United Nations Entity for Gender Equality and the Empowerment of Women; WFEO, World Federation of Engineering Organizations; WHO, World Health Organization; WIPO, World Intellectual Property Organization. WTO, World Trade Organization.
3. TNA country reports are available at the following link: http://unfccc.int/ttclear/templates/render_cms_page?TNR_cre (last access Jun. 9th 2014)
4. http://www.thegef.org/gef/whatisgef
5. http://gec.jp/
6. Abbreviations used in the figure: TNA: Technology Need Assessment; TAA: Technology Availability Assessment; FS: feasibility Study; PP: Pilot Project; MRV: Monitoring, Reporting and Verification process; CB: Capacity Building.
7. Under a project conducted by IGES-KRC in India, the gas price rose from 28Rs/SCM to 42Rs/SCM between the date of FS (Dec. 2012) and the date of actual pilot project implementation (Dec. 2014).

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