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BRIEFING PAPER

Partnerships for Technology Transfer
How can investors and communities build renewable energy in Asia?

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Photo by Tim Forsyth,
Baguio, Philippines, 2001.

Summary

• Technology transfer for climate change mitigation needs to focus on the diffusion of existing technologies as well as the innovation of technologies.

• Diffusion requires full involvement of non-state actors, particularly business investors in new and renewable energy technologies and the local communities who adopt technologies.

• This paper presents advice about how partnerships between investors and communities can accelerate technology transfer by reducing investors' costs and making technologies more relevant to local development. Partnerships are based on a combination of creating assurance mechanisms, reducing transaction costs, and building trust and accountability.

• Capacity-building and enabling environments for technology transfer therefore have to include building these partnerships between investors and host communities.

Introduction

In June 2004, the Expert Group on Technology Transfer (EGTT)[1] of the United Nations Framework Convention on Climate Change (UNFCCC) urged an important new approach to international technology transfer. Since its establishment in 2001 at the climate change meeting in Marrakesh, the group has built capacity for the supply of new technologies, especially through innovation and development strategies involving partnerships between governments and private companies.

But in June 2004, business members of the EGTT called for a more diverse approach (UNFCC, 2004). They claimed that so far the group had tended to focus too exclusively on the supply of technologies, and on activities involving governments or international organizations. Instead, they urged that more attention be given to the business needs of companies who distribute environmental technologies. Moreover, they suggested that the group needed to acknowledge technology 'diffusion' as an important process alongside innovation and development. In essence, they recommended that more attention should be given to the demand-led aspects of technology transfer, which in turn required greater capacity-building in the interactions of non-state actors such as companies and host communities.

This Briefing Paper summarizes new thinking on ways to enhance technology transfer through the interactions of investors and communities. In particular, it analyses different approaches to 'partnerships' between companies and communities. It calls upon the EGTT and UNFCCC to focus more upon how to make partnerships successful, as a crucial way to ensure that technology transfer can proceed.

The paper describes the potential contribution of partnerships to technology transfer. It then illustrates this with examples of investment in renewable energy and waste-to-energy technologies in India, the Philippines and Thailand. Finally, it draws lessons for capacity-building, community involvement and 'enabling environments' for technology transfer, as currently discussed under the UNFCCC and United Nations Environment Programme (UNEP).

The problems of technology transfer

'Technology transfer' is well known to be an important but controversial topic within international environmental negotiations (IPCC, 2000). In environmental terms, technology transfer refers to the need to encourage the adoption of new, clean technologies in countries or locations where such technology is not yet commonplace. Some developing countries refused to sign the UNFCCC and Agenda 21 before developed countries had stated some commitment to technology transfer.

Achieving technology transfer, however, has been difficult for various well-documented reasons (see Forsyth, 1999). First, technology transfer is difficult to define. Companies do not engage in 'technology transfer' as such, but instead with 'leases,' 'contracts' or 'joint ventures,' all of which may include scope for encouraging technology use in new locations but are aimed primarily at increasing business access. Secondly, most environmental technology is now privately owned, and few companies wish to share it without compensation. Third, long-term technology transfer is costly, and requires training local people to use and maintain technologies; few companies wish to do this, and often see it as the responsibility of international organizations or official development assistance. Fourth, it is sometimes difficult to agree on what is 'environmental technology,' and technologies have varying environmental impacts for different stakeholders. Furthermore, many technologies in developing countries may also have environmental benefits and be more appropriate to end-users than some imports. Fifth, despite environmental benefits, some technologies have proved inappropriate for local users and have consequently been abandoned. Sixth, many programmes of technology transfer have failed to acknowledge the need for long-term financial security and cost-recovery by investing companies: companies require regular repayment of costs, which may require the establishment of new accounting and financial bodies locally to achieve this. In addition, the common use of subsidies as an incentive to adopt new technologies has frequently backfired by creating short-term and unsustainable economic conditions that have repelled both investors and consumers.

Consequently, 'technology transfer' is not one simple process but the conjunction of various acts, over a long time, for a wide range of products and services. Technology has to be *appropriate*: it has to be seen to be useful by local people, or in tune with other local products and markets. (For example, one United Nations project in India in the 1970s to introduce electricity generators using cow dung failed to predict that the price of dung would increase, leading to a shortage of fuel. In the Philippines in the 1980s, photovoltaic-powered water pumps were seen to be unnecessarily complicated compared with pre-existing hand-pumps, and hence abandoned). Technology requires *financial management*: there is little point encouraging private investors to sell new technology or engage with other companies in joint ventures if they cannot guarantee long-term recovery of costs. (For example, the development agency Winrock International transferred new wind turbines in remote parts of eastern Indonesia by creating locally controlled financial management organizations in villages ('distributed utilities'). Technology therefore requires both *hardware* (equipment) and *software* (management, training, education) that allow new technologies to be adopted on a long-term basis on terms acceptable to both investors and users. Technology transfer also includes *partnerships* with local companies and citizens in order to supply components and labour, and to gain understanding of products.

Moreover, some analysts have suggested that

technology transfer may follow two main paths. *Vertical technology transfer* involves the relocation (or sale) of technology products without the sharing of intellectual property, usually by the granting of sole production rights to one investor, or the simple sale of finished products to consumers in a new location. *Horizontal technology transfer* involves the long-term sharing of intellectual property, usually via a joint venture or cooperation between foreign direct investor and a domestic company in the host country. Most discussions of technology transfer in international meetings to date have implied horizontal transfer. But increasingly, vertical transfer has been proposed as a way to enhance international technology transfer without risking intellectual property rights or high costs as described above.

BOX 1: UNIVERSAL CRITICAL SUCCESS FACTORS FOR RENEWABLE ENERGY DEVELOPMENT

1. *Investment must fit the medium-term strategy of energy development.*
2. *Investment must use proven or reliable designs.*
3. *Projects must be based on least-cost approaches.*
4. *Appropriate finance must be arranged to cover risks.*
5. *There must be adequate marketing and technical staff.*
6. *There must be a proven market for the technology.*
7. *Do not give free gifts or overt subsidies (such as short-term grants).*
8. *Ensure that a market chain exists between suppliers and consumers.*
9. *Consider site-specific factors in each location.*
10. *Operate in locations where regulations and laws are favourable.*
11. *Create an acceptable tariff structure to cover costs.*
12. *Disseminate programme results to create market demand.*
13. *Conduct adequate project reviews to identify weak points.*
14. *Expect demand for products to grow once established.*

Source: Forsyth (1999), after Stainforth and Staunton (1996).

Approaches to technology transfer under the UNFCCC and UNEP

Since the signing of Agenda 21 and UNFCCC in 1992, various organizations have sought to create enabling environments for technology transfer. But approaches have often differed according to whether participants are from developed or developing countries (UNFCCC,

2003b:4). In general terms, many developing countries have wanted richer countries to facilitate technology transfer by stimulating the supply of technologies via mechanisms such as government-to-government transfers, or increasing financial and technical support, primarily through horizontal forms of technology transfer. Many developed countries, however, have pointed to the need to create incentive mechanisms for private companies which own technologies, and sufficient protection of intellectual property rights for investors. Such debates have been seen in relation to the Clean Development Mechanism (CDM), which was created in 1997 to allow Annex I (i.e. developed) countries to achieve some proportion of emissions targets through climate-friendly investment in non-Annex I (usually developing) countries.

In 2000, a special report from the Inter-governmental Panel on Climate Change (IPCC, 2000) identified technology transfer as a five-stage process, including assessment, agreement, implementation, evaluation and adjustment, and replication (diffusion) of both technological 'hardware' and 'software.' But since then, most attention has been given to state- and supply-led initiatives, rather than those that involve interactions of investors and communities. In the 2001 Marrakesh Accords, the UNFCCC stated: 'the enabling environments component of the framework focuses on government actions, such as fair trade policies, removal of technical, legal and administrative barriers to technology transfer, sound economic policy, regulatory frameworks and transparency, all of which create an environment conducive to private and public sector technology transfer' (UNFCCC, 2001: 65). Indeed, the Marrakesh Accords also created an 'adaptation fund' as part of the CDM to raise money to conduct long-term assistance in developing countries, such as horizontal technology transfer. But this was criticized by some observers for effectively taxing CDM investment and failing to ensure that technology transfer (either horizontal or vertical) could be included as a prerequisite in CDM projects as a matter of course.[2]

Later statements by the UNFCCC have reiterated the role for government action by listing activities such as providing information, financial flows, and improving legal frameworks. SBSTA has been closely involved in developing a technology information system (TT: CLEAR[3]), including an inventory of the Energy Saving Trust (EST) and projects. However, making contact with end users of technology has largely been left to socially concerned NGOs. In 2003, the UNFCCC asserted: 'governments can create enabling environments for EST diffusion and transfer if they endorse the importance of socially and environmentally oriented organizations and mandate social impact assessments for technology transfer projects' (2003b:16). Such statements, of course, indicate the valuable role played by intermediary NGOs, but fall short of acknowledging the commercial needs and interactions that drive non-state actors to engage in practices that result in 'technology transfer'. Similarly, a further UNFCCC technical paper (UNFCCC, 2003a: 4) adopts a state-led perspective; its assertion that 'transferring experience, knowledge, skills and

practices is "capacity-building"' suggests that end users may not have their own existing capacities to be strengthened.

Other work by the IPCC and UNEP has focused explicitly on community involvement. But these approaches have not always been complementary. In its special report on technology transfer, one chapter (written by different teams of authors) urged greater involvement of host communities in both shaping and monitoring technology transfer: 'participatory development is now widely recognized as a way of achieving technology transfer at all levels of development endeavor' (IPCC, 2000:117[4]). Yet, in a later chapter, other authors downplay community consultation: 'technology transfer… will be most effective where it engages all key stakeholders in designing and implementing technology transfer actions. The key stakeholders include in-country and international private businesses and investors, government agencies, and bilateral and multilateral donor organizations' (IPCC, 2000:163[5]).

Meanwhile, statements by UNEP have reiterated the need for a participatory approach. 'Participation of the community, and its partnerships with other stakeholders, has become an important component of all environmental programmes and projects, both in terms of subsidiarity of decision-making processes, and of creating an enabling environment for the community to have a say over aspects that affect their lives' (UNEP, 2004: 1). But statements so far have tended to indicate how far local or national governments can act to increase local participation in predefined environmental objectives, rather than allowing citizens to participate in making new technologies appropriate. UNEP (2004: 4) declares: 'community participation means a readiness on the part of both local governments and citizens to accept equal responsibilities and activities in managing their surroundings' and 'community participation calls for clear commitment and involvement of all members of a community in various joint activities' (UNEP, 2004: 5). The first of these statements seems to suggest that communities might share the same vision of environmental priorities as governments. The second suggests that 'communities' may be homogeneous and think alike. Neither is likely to be true. Accordingly, there is a need to acknowledge greater diversity of needs and people within communities before seeing how they can interact with private companies.

The next section considers some ways to understand these kinds of non-state partnerships. In particular, partnerships can help overcome problems of technology diffusion by reducing investors' costs, and by increasing the ability of citizens to determine the uses of technology.

The potential of partnerships

The first section of this paper explained that successful technology transfer requires cost recovery for investors, and the perception that technology is appropriate and useful by local communities. The second section argued that formal approaches to capacity-building by the UNFCC have not sufficiently considered non-state activities; this section asks: 'how can partnerships between investors and local communities help technology transfer'?

Partnerships may take many forms, and may include collaboration between investors and local companies, local governments and citizen groups. Sometimes, collaborating with citizens may also include working with local companies in order to gain both local supplies and local trust. Public–private partnerships between private companies and governments are already well established as a fast way to provide infrastructure in rapidly industrializing countries. This kind of partnership may involve a Build-Operate-Transfer (BOT) scheme (or similar versions), enabling companies to construct infrastructure and operate it profitably for a limited number of years before ownership is given to the government. But in recent years, a broader definition of 'policy partnership' has emerged to describe greater collaboration between governments, investors and citizens. These partnerships have been encouraged under the United Nation's Global Compact and Millennium Development Goals as a way to harness the vast resources of international private investment, as well as allowing end users greater consultation in how development projects evolve. But can partnerships exist at lower levels between individual investors and localities? What do successful partnerships look like? We first consider the needs of business, and then of citizens.

(i) Partnerships and business needs

As discussed above, investors want few technical barriers to investment; large consumer demand for their products; little resistance to their technology; and a financial system that allows long-term cost recovery. Conceptually, partnerships using these factors can be summarized in terms of *transaction costs* and *assurance mechanisms* (Weber, 1998). Transaction costs may be defined as costs of interaction (such as financial cost, time in negotiating with different actors); and assurance mechanisms may be defined as contracts, laws or expectations (formal or otherwise) which ensure that collaboration or partnerships will provide each party with their desired result. An ideal partnership between actors should have minimum transaction costs, and maximum assurance mechanisms (see Box 2). It should be noted, however, that the emergence of successful partnerships varies according to several factors, including willingness to cooperate; long-standing trust of each party; and a shared or compatible perception of the underlying problem. Also, the ability to collaborate may vary between other companies, and between local citizen groups.

(ii) Partnerships and community needs

For their part, local citizens want technology that is appropriate (useful for their needs and circumstances), easily understood and seen to have few risks for

BOX 2: CONDITIONS INFLUENCING THE EMERGENCE AND MAINTENANCE OF COLLABORATION

Transactions costs of alternative

The assurance mechanism	High and applicable to all stakeholders	High for most, but not all stakeholders	Low
None	No collaboration	No collaboration	No collaboration
Partial	Collaboration possible, but not sustainable	Highly unlikely	No collaboration
Full	Sustained Collaboration	Collaboration possible, but not sustainable	No collaboration

Sources: Williamson, 1996; Weber, 1998: 34.

health, safety or local economic development. Local collaboration with investors has been called 'cooperative environmental governance' by some analysts (e.g. Glasbergen, ed., 1998). This refers to a system of decision-making about environmental technology and investment that includes participation of local citizens, and the search for mutual objectives between investors and communities. Such partnerships are usually characterized by clear – and unanimously agreed – objectives of investment and technology; the existence of clear and accountable negotiating arenas where all citizens can express views; and, frequently, the existence of help from government departments (such as environmental agencies) to provide environmental and technical expertise.

Yet critics have proposed, first, that the notion of a single 'community' is flawed because of the variety of people and social groups within locations such as cities in developing countries: it is therefore difficult to allow local partnerships that include all citizens on an equal basis. In the context of this paper, some examples of people who are difficult to represent in partnerships are waste pickers, or people who segregate municipal waste in developing-world cities. Secondly, critics have claimed that few partnerships are conducted without some element of bias and co-option of citizens: local elites may have links to businesses or government agencies. Third, some have suggested that reaching truly local partnerships is impossible because citizens are frequently influenced, or represented, by activist groups such as non-governmental organizations (NGOs) or campaigning groups that have national or international links. Indeed, some NGOs such as Greenpeace have in recent years opened offices in Asian cities and adopted international campaigns against toxic pollution.

Because of these concerns, some critics assert that partnerships between citizens and investors may actually reduce the ability for local citizens to influence investment in their locality, and that partnerships are perhaps less preferable to full state regulation. This paper, however, seeks to assess the possibility of making local partnerships between investors in environmental technology with local communities, and to see if it is possible to overcome these difficulties and achieve a new form of environmental policy that can transfer technology, reduce investors' costs and provide new services for citizens.

Case study: waste-to-energy investment in Asia

Waste-to-energy is both controversial and topical. Municipal waste is growing in many developing-world cities: locally it is the source of disease and pollution; globally it causes methane emissions through decomposing organic matter. Methane is an important greenhouse gas because it has 23 times the global warming potential of carbon dioxide. Using waste to generate electricity may reduce waste totals and reduce greenhouse gas emissions as well as generating badly needed energy for industrialization. Burning agricultural waste to produce energy has long been practised in many places. Critics, however, suggest that municipal waste-to-energy is controversial because it may make planners tolerant of waste, rather than seeking to reduce it. Moreover, the choice of technology for waste-to-energy is important: incinerating municipal waste (including using newer technologies such as pyrolysis[7]) emits potentially dangerous dioxins because it burns most waste material, including plastics. But biomethanation of municipal waste (or so-called anaerobic digestion) uses only the organic fraction of the waste, and involves no burning. Biomethanation therefore promises methane extraction (for electricity generation), a residual sludge (used for composting), and the potential to recycle the remaining municipal waste. At present, many investors are using both incineration and biomethanation to claim financial rewards under the climate change agreement, although critics are working to ban incineration from this process.

Waste-to-energy is a good example of the construction of partnerships between investors and citizens. There is immense demand from developing countries for technologies that can generate electricity and reduce waste. Waste management in developing countries frequently involves a wide sector of society, from richer companies and neighbourhoods, to the so-called 'waste pickers,' who collect or recycle waste as their livelihood. Investment in waste-to-energy therefore offers the possibility of achieving benefits for companies, for local communities and for international environmental policy concerns.

(i) The importance of assurance mechanisms

As noted above, assurance mechanisms are contracts, laws, and expectations that ensure each side of a partnership will cooperate. Two examples from the Philippines and Thailand show their importance.

Between 2000 and 2001, Enron, the US-based multinational energy investor, sought to develop a $96m, 40MW energy plant using rice husks in the province of Bulacan, in Luzon. Bulacan is one of the most important rice-growing regions of the Philippines, and the large quantity of rice husks produced as agricultural waste offered an important opportunity for using efficient incineration methods to convert these to energy. However, the project failed when the financiers learned how Enron had organized its contracts for supplying rice husks. It had made contracts with some 150 rice millers in order to supply rice husks, and needed to maximize supply in order to fuel its large 40MW plant. The rice millers quickly discovered that Enron had no other suppliers of rice husks, and so they were able increase the price, thus eroding Enron's profitability. Under these conditions, the financiers withdrew their support.

An alternative outcome was illustrated by a different case in Thailand. Between 2000 and 2004, a Thai-owned company, AT Biopower, sought to build six 16MW power plants using rice husks in the central plains of Thailand. The plan differed from Enron's project in the Philippines in many ways. First, the Thai company sought to build a number of smaller power plants, rather than one large 40MW plant. Secondly, the investor used a variety of techniques to ensure that the supply of rice husks remained constant – for example, making contracts with just 20–30 rice millers per power plant, rather than 150: and seeking to use just 10-15% of their total rice husk production, rather than 100%, as was the case in Bulacan. The power plants therefore experienced lower transaction costs through dealing with fewer rice millers than in the Philippines, and did not rely on each miller's total rice husk production. Furthermore, millers are contracted to produce a guaranteed quantity of husks: they are fined if they fail to deliver, yet are also rewarded with a yearly bonus if they achieve their target. All of these techniques are assurance mechanisms to ensure that partnerships between companies succeed. Yet they are also crucial to ensuring the successful embedding of new energy technologies.

(ii) The importance of transaction costs

Transaction costs are the costs of interacting with partners, and usually refer to financial costs; time spent negotiating; and problems of misunderstanding. The best partnerships have fewest transaction costs. But defining transaction costs may also include knowing where to draw boundaries between partners, with regard to which activities each is responsible for. Examples from the Philippines show the need to reduce costs with different partners.

Between 1996 and 1998, a US-based investor in biomethanation sought to establish a new methane-recovery and electricity generating plant in Ayala Alabang near Manila in the Philippines. The investing company used two techniques to reduce transaction costs and maximize revenue for itself. First it negotiated a contract with a local NGO to allow the NGO to supply waste from pigs and cows in the region. This was in both parties' interests: the US investor did not want to spend money on collecting waste (it had no expertise in this area, and the transaction costs of paying local collectors was too high); in addition the NGO wanted to reduce waste locally. Secondly, the NGO also negotiated another contract with the local municipal government to buy the entire municipal waste stream from the locality, and hired local waste pickers to sort it into organic and inorganic waste. Segregating the waste in this way is necessary in order to extract the organic material for biomethanation, and to make money from recycling inorganic material such as metal and paper.

Unfortunately, this investment project failed for several reasons. The most important was that local landowners (including the municipality) increased the rent payable on the power plant's land because they believed the project was more profitable than it was. But in addition, the investing company quickly realized that the stream of recyclable (inorganic) waste was much smaller than they had anticipated because the waste pickers and waste transporters were removing the most valuable elements before they arrived at the plant. The company quickly discovered that it could not control the supply of recyclable waste, and so decided to omit waste recycling from its business objectives. It has since focused on biomethanation, composting and carbon credits as its main profits, and has left most recycling to the local people.

Using partners to reduce, rather than increase, transaction costs, seems to be the lesson. In other projects, local waste pickers have also been hired to collect or segregate waste because it allows investment projects to be accepted by local people as opportunities rather than threats to their livelihoods. It also allows investors to find areas of collaboration that maximize mutual benefits, and the same US investor has later persisted with other biomethanation projects. In the Philippines, notably in Baguio in the northern island of Luzon, and General Santos in Mindanao, where local people are hired in order to undertake waste sorting, but where the investor does not seek to restrict the local people from recycling in ways that benefit them. Much of this success comes from defining boundaries around different business activities: the investor focuses on biomethanation and electricity generation; the local pickers on recycling. This way, both sides can maximize their own profits without undermining the partnership.

(iii) The importance of trust and transparency

But partnerships between investors and local companies and citizens can easily be undermined by a loss of trust, or worries about the new technology. Local partnerships are not simply a pragmatic way of introducing new environmental technologies; they are

also seen by many people to be new business opportunities that benefit some people more than others, or as political acts. Often, the political perceptions of partnerships are controlled by factors outside the immediate control of investors. But what can be done to make partnerships acceptable?

In Thailand, AT Biopower (mentioned above) tried to build one 16MW rice husk power plant in central province of Suphan Buri in 2000. This time, the proposal caused widespread protests by local farmers, who feared the plant would extract water, reduce rainfall and cause pollution. There were even fears that the plant would cause sterilization of anyone who walked under the power cables. Protests against the plant were reported in the national newspapers. These fears were caused by general worries about industrialization and pollution from power plants in Thailand, and by (alleged) misinformation spread by people who wanted to influence where the plant would be located.

In the Philippines, investors in biomethanation have also experienced opposition from national and international NGOs who are opposed to waste-to-energy in general. Environmentalists (and especially the NGO Greenpeace) undertook a successful campaign to ban incineration of urban waste, and to enforce segregation of waste at source into organic and inorganic. These steps were taken to reduce the vast production of waste that is now overloading the Philippines' cities, and to resist incineration of waste. But this activism has also included opposition to biomethanation, even though it does not involve incineration. Few activists understand the process of electricity generation via anaerobic digestion, and some believe any form of waste-to-energy is unacceptable because it legitimizes the production of waste. In the city of Baguio, one US investor faced opposition from a local NGO who claimed that the biomethanation technology would destroy people's livelihoods by preventing them from making compost.

There are, of course, many examples of political activism undermining investment in new technologies. But how can companies overcome local resistance? In these case studies, investors took several steps to improve local trust, and to seek win-win solutions. In Suphan Buri, AT Biopower undertook an extensive public education campaign, seeking to explain how rice husks would lead to electricity generation without significant pollution. The investor also committed funds from the plant to support local community development projects, and allowed citizens to monitor pollution, with a commitment to pay compensation if pollution exceeded limits.

In the biomethanation plants, the investors deliberately tried to win local support by offering jobs to the local waste pickers and other residents who were concerned. This approach was also adopted in India's largest plant using biomethanation of municipal waste. The plant, in the Uttar Pradesh town of Lucknow, opened in 2003, generating some 5MW of electricity from between 400 and 500 tons of organic municipal waste a day. It is operated by an Asian-based company with a variety of international shareholders.

The company also works in cooperation with an Indian NGO, Exnora, which has pioneered the involvement of waste pickers in urban waste management. When asked why the company adopts this philanthropic attitude to waste pickers, a representative said, 'We don't want to upset the existing social system. Our main income comes from power, fertilizer and carbon credits. The recyclable income is not significant to us, but it is significant to society … we are not depriving people of livelihoods'.

But this active involvement of waste pickers in partnerships between investors and citizens is fragile, and can be controlled by the publicity or preferences of different companies. In the Indian city of Chennai (Madras), an Australian investor is seeking to build a waste-to-energy plant based on pyrolysis of urban waste. This technology has received much criticism within India on the grounds that it may release too many pollutants (a claim the investor denies), and that it is an insufficiently short-term solution to the creation of urban waste. To conduct pyrolysis successfully, the company has to collect the entire municipal waste stream, including papers and plastics, and burn these to gain sufficient calorific values in the waste. The company does undertake some limited recycling (for example, of metals), but there are fewer opportunities for local waste pickers to be involved. The investor defends this position by saying it is happy for waste pickers not to be involved, as using labour this way is not healthy or just. Critics suggest that this statement is simply a way to protect the supply of waste for pyrolysis.

The implication of these examples is that governing public happiness by means of partnerships between local people and investors can be very difficult and beyond the control of investors. Most companies have tried to maximize public trust by proving information about the new technologies, and by including many different people in the production process. But some technologies – such as pyrolysis – must control more of the waste stream and therefore provide fewer opportunities for local involvement. Furthermore, in the political battles surrounding the choice of waste-to-energy technology, statements are often not linked to localities, but come from national or international NGOs and activists.

Lessons for building partnerships for technology transfer

So what are the lessons for using partnerships to transfer environmental technology to new locations? How can collaboration reduce the costs of investors, and increase the success of environmental technologies in rapidly industrializing countries? The discussion above suggests five general points.

(i) Be feasible: Most examples of successful partnerships are based on targets that are achievable and that can form a successful template for further projects. Enron's failed rice husk project in Bulacan in the Philippines

failed because it sought to generate 40MW. But AT Biopower in Thailand has proved that smaller plants (of 16MW) can work. Similarly, forming partnerships with fewer numbers of partners may be more achievable than working with larger numbers.

(ii) Maximize assurance mechanisms: Assurance mechanisms are the devices – such as contracts and understandings – that keep both partners together in a partnership. In Thailand, AT Biopower successfully created incentives to ensure that the suppliers of rice husks honoured their contracts by making sure the power plant was not dependent on any one supplier, and by giving cash bonuses to suppliers who performed well. In the Philippines, investors in biomethanation sought successful collaboration with local citizens by ensuring that both parties had something to gain from the completion of power plants (i.e. citizens benefited from waste reduction and the opportunity to profit from recycling; the company gained from having access to the organic waste).

(iii) Minimize transaction costs: Transaction costs are the costs of interaction that can make or break a partnership. In the Philippines, investors in biomethanation realized that transaction costs would be reduced once clear boundaries were established around the ownership of and participation in the waste treatment process. Successful assurance mechanisms can also mean reduced transaction costs, as both sides have incentives to perform. Reduced transaction costs usually mean understanding what aspects of the partnership are most important for one party, and specializing on these, rather than assuming all aspects of interaction will be successful.

(iv) Be aware of politics: Political activism and environmental campaigns may get in the way of successful collaboration. If companies establish successful assurance mechanisms and low transaction costs, then there may be a small chance of political activism getting in the way of partnerships. But political activism may emerge for factors beyond companies' control, and may result from more general worries about the role of foreign investors in the domestic economy; the role of an allegedly corrupt local government in favouring one company above others; or fears about technology and environment that may or may not be well founded. In such cases, some companies have responded by trying to control their own image. The Australian investor in Chennai, for example, sought to legitimize pyrolysis by delegitimizing using waste pickers in waste management. In the Philippines, some activists unfairly accused biomethanation of being another form of incineration. In these cases, companies have responded by engaging in gentle dialogue with critics, and by including some element of community development into their projects. In many ways, being aware of politics is a broader way of maximizing assurance mechanisms and minimizing transaction costs.

(v) Work with others: Finally, partnerships often result not only from the hard work of specific companies or business managers, but from the coincidence of various local, national and international factors. In the Philippines, a national law requiring all municipal waste to be segregated may help partnerships emerge between investors who want to build biomethanation plants and local citizens who are worried about increasing waste totals. In Lucknow, India, the local government had a role in establishing a new biomethanation power plant by urging companies to adopt a positive attitude to hiring local waste pickers. National and local NGOs may also seek to engage constructively with companies – for example, the NGO Exnora in India has established beneficial relationships with some waste management companies. For environmental policy, involving different actors in business, society, and government increases the chances of cooperation, and decreases dependency on any one actor. Box 3 summarizes some potential roles played by different actors.

Rethinking capacity-building for technology transfer

Finally, what are the lessons for policy approaches to technology transfer? And what can the EGTT and UNFCCC do to adopt them?

This paper has argued that formal approaches to capacity-building under the UNFCCC have tended to emphasize actions by governments and large donors, especially within innovation and development of technology, rather than ways in which non-state actors can implement technology diffusion. Of course, innovation and development remain important, as do activities such as increasing fair trade policies, protecting intellectual property rights, or increasing public access to, and information about, technologies. But capacity-building, and technology transfer in general, should not just be defined in these terms.

According to the UNFCCC (2003a: 4), capacity-building is 'transferring experience, knowledge, skills and practices'. This paper argues that capacity-building is more than transferring such factors, and should include greater attention to strengthening existing factors that allow actors to reach agreements for adopting technologies. In essence, this requires seeking ways for investing companies to recover costs on a long-term basis, and appreciating that technologies are seen as appropriate by local users. Unlike governments and environmental organizations, investors and communities do not always perceive 'technology transfer' as an activity in its own right. Understanding what motivates such actors to get involved in activities that assist technology transfer is an important way to build capacity for technology transfer. Capacity-building may also include reducing the transaction costs of collaboration, and diversifying forms of assurance mechanisms for partnerships (see Box 3). The

EGTT can diversify its work on capacity-building and enabling environments by acknowledging how different actors may see these, and facilitating ways for communities and investors to form partnerships to assist technology diffusion.

A further need for capacity-building is to acknowledge that 'communities' are more diverse than is commonly described. UNEP (2004: 5) has written that 'community participation calls for clear commitment and involvement of all members of a community in various joint activities (with local governments)'. But – as shown in the case studies – partnerships are rarely formed with all community members, and each act of collaboration has involved winners and losers within communities. Governments may seek to educate communities as a whole, or to supply technologies such as solar lanterns to each household. But seeking contractual arrangements or commercial partnerships between communities and investors will rarely involve all citizens. Recognizing the diversity of needs and actors within communities may help capacity-building for technology transfer by identifying different opportunities for appropriate technology.

Partnerships between investors and local companies and citizen groups clearly involve various costs and learning procedures that may get in the way of investing in new environmental technologies. But for some investment and technologies, engaging with other parties may be the only way to make progress. The examples discussed above show that successful partnerships might reduce investors' costs, and increase the relevance of new technologies for local people in developing countries. The EGTT and UNFCCC can assist technology transfer further by helping end users and investors form partnerships for technology diffusion.

BOX 3: BUILDING CAPACITY FOR CLIMATE TECHNOLOGY TRANSFER VIA PARTNERSHIPS BETWEEN COMMUNITIES AND INVESTORS

Actions for national governments
- National legislation such as the Philippines' Clean Air Act and Solid Waste Act, which seek to attract investment in 'clean' technologies; educate residents about waste segregation; and prepare waste for treatment.
- National programmes for building investment in renewable energy technologies such as Thailand's Small Producer Programme and Biomass Programme, which offer an initial subsidy for plants to invest in new technologies to use waste products for electricity generation.

Actions for local governments
- Seek strong action and united support for projects that integrate waste management with generation of electricity.
- Seek support from national or local NGOs to ensure any investment does not result in costly disputes.
- Ensure that benefits of new technology schemes are seen to be distributed locally, such as access to the electricity generated, or by-products of waste segregation.

Actions for businesses and investors
- Seek collaboration with local NGOs or citizen groups who may be able to point to synergies and complementarities in aims that may lead to cost-saving opportunities.
- Allow time and money for educating residents about the objectives of the investment and technology, including frank discussion about who wins and loses.
- Avoid depending on a limited number of suppliers or collaborators, as they may be willing to exploit this dependency later on.

Actions for citizen groups and NGOs
- Seek collaboration with businesses with which there may be complementary aims, as they may provide commercial incentives for public-policy objectives such as waste collection, or training of unskilled workers.
- Participate in training and education if possible.

Actions for all actors
- Seek public debate about public–private collaboration, how private and public objectives may offer complementarity, how past experience may shape current perceptions of collaboration, and how

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Endnotes

[1] The EGTT was established by Parties at the seventh Conference of the Parties to the UNFCCC (COP-7) held in Marrakesh in November 2001. The objective of the EGTT is to enhance the implementation of Article 4, paragraph 5, of the Convention, *inter alia* by analysing and identifying ways to facilitate and advance technology transfer activities and making recommendations to the Subsidiary Body for Scientific and Technological Advice (SBSTA).

[2] The CDM Adaptation Fund is based on the extraction of 2% of the value of Certified Emission Reduction Units achieved by each CDM project.

[3] *http://ttclear.unfccc.int/ttclear/jsp/.*

[4] M. McKenzie Hedger and E. Martinot (coordinating lead authors), 'Enabling environments for technology transfer,' pp.105–42 in IPCC (2000).

[5] M. Mansley and E. Martinot (coordinating lead authors), 'Financing and partnerships for technology transfer,' pp.143–74 in IPCC (2000).

[6] Pyrolysis is a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. It typically occurs under pressure and at operating temperatures above 430°C (800°F).

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