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Enhancing climate technology transfer through greater public–private cooperation: lessons from Thailand and the Philippines

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Abstract

This paper contributes to debates about climate change policy and technology transfer by analyzing the success factors underlying collaboration between private companies and communities in developing countries. To date, much attention to capacity building for enabling environments –including public–private collaboration– under the climate change convention has focused on state-led initiatives and on the innovation and development of technologies. This paper, instead, focuses on how private-sector investors and host communities may collaborate in the diffusion of technologies, by reducing the costs of technology transfer, and making technology more appropriate to developing countries. The paper describes cases of collaboration concerning waste management and waste-to-energy in Thailand and the Philippines. The paper argues that successful public–private partnerships between investors and communities depends on minimizing transaction costs, strengthening collaborative (or assurance) mechanisms, and in maximizing public trust and accountability of partnerships. Lessons are then drawn for enhancing capacity building for technology transfer under the climate change convention and applications such as the Clean Development Mechanism.

KEYWORDS: climate change policy; capacity building; community participation; environmental governance; technology transfer; waste-to-energy; public–private partnerships; Thailand; Philippines

Introduction

This paper contributes to debates about climate change policy and technology transfer by analyzing the success factors underlying collaboration between private sector investors and local communities in developing countries.

Technology transfer is now widely recognized as an important means of implementing policies to mitigate anthropogenic climate change. Indeed, technology transfer also forms a crucial element of environmental 'leapfrogging' – or the ability for developing countries to undergo industrialization without the same levels of pollution as experienced elsewhere (Perkins, 2004). In recent years, various policymaking organizations have urged that technology transfer involves multiple stakeholders in both state- and non-state sectors, and that stakeholders should collaborate to enhance technology transfer (IPCC, 2000). Historic experience, however, has suggested that successful collaboration among non-state actors has been hampered by two important factors.

First, successful technology transfer by private companies has frequently not occurred under artificial conditions of subsidies and grants, but instead requires long-term and reliable cost recovery. Building capacity for technology transfer therefore does not just mean identifying potential uses for new technologies, but also in creating mechanisms that allow new technologies to be paid for locally, and kept competitive under market conditions (Gregory *et al*, 1997; Martinot, *et al*, 1997).

Second, technology transfer cannot succeed without an appreciation of the local socio-economic needs and concerns of host communities. Many historic attempts at technology transfer have failed because intended users have not understood or even opposed new technologies, or because planners have failed to appreciate the impacts of technological change on the prices and availabilities of local resources. Capacity building for new technologies therefore also requires researching local perceptions and needs for technology (UNEP, 2003).

These problems were acknowledged by the Expert Group on Technology Transfer (EGTT) of the United Nations Framework Convention on Climate Change (UNFCCC) in June 2004 (UNFCCC, 2004). Business representatives within the EGTT noted that much Capacity building for technology transfer had so far 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 and on the interactions of private investors and end users. But, to date, there has been comparatively little discussion of the success factors underlying such collaboration between non-state actors.

This paper seeks to address this concern by identifying the success factors within collaboration between private investors and local communities in developing countries. By doing this, the paper also seeks to advance understandings of public–private collaboration: ‘private’ referring to the private-sector investors in new and renewable energy technologies, and ‘public’ referring to citizens, or ‘the public’ at large. These non-state actors are most intricately involved in the kind of technology diffusion discussed by the EGTT. Moreover, many observers of climate change negotiations have proposed that this kind of community involvement in technology transfer and UNFCCC-related investment projects should offer a so-called ‘development dividend’ by integrating climate change mitigation and local development needs (IISD, 2004).

The paper is divided into three key sections. The first reviews debates about technology transfer for climate change mitigation, the responses of the UNFCCC, and the potential role of new approaches to partnerships in enhancing technology transfer. The second considers case studies of public–private partnerships involving investors and communities in Thailand and the Philippines in the growing sectors of waste management and waste-to-energy, which are often considered to offer ‘development dividends.’ The third draws lessons from these case studies for policy debates, including the implementation of the Clean Development Mechanism (CDM), and capacity building for technology transfer.

Climate technology transfer and public-private cooperation

(i) Technology transfer and climate change mitigation

'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 Martinot *et al*, 1997; Forsyth, 1999ab; UNEP 2003).

- First, technology transfer is difficult to define. Companies do not engage in 'technology transfer' as such, but instead with 'leases,' 'contracts,' or 'joint ventures,' which are primarily business concepts with scope for encouraging technology use in new locations.
- 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 these as the responsibility of international organizations or official development assistance.

- Fourth, it is sometimes difficult to agree on what is ‘environmental technology.’ Technologies have varying environmental impacts for different stakeholders. Sometimes domestic technologies in developing countries may be more appropriate to local uses than some imports.
- Fifth, despite environmental benefits, some technologies have proven inappropriate for local users and have consequently been abandoned.
- Sixth, many programs of technology transfer have failed to acknowledge the need for long-term financial security and cost-recovery by investors. Cost recovery may require the establishment of new local accounting and financial bodies to collect payments, which requires a new level of management and intervention. Related to this, cost recovery has to be conducted in careful conjunction with any subsidies. Subsidies have often backfired as incentives to adopt new technologies by creating short-term and unsustainable economic conditions that have repelled both investors and consumers. But careful use of subsidies, with long-term movement to full cost recovery, can ensure successful technology transfer (Gregory *et al*, 1997).

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 called distributed utilities). Technology therefore requires both *hardware* (equipment) and *software* (management, training, education) that allow new technologies to be adopted over 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, labor, and to gain understanding of products.

Moreover, some analysts have suggested that technology transfer may undertake 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. This paper largely considers the successful embedding of vertical forms of transfer.

Box 1 suggests some critical success factors underlying technology transfer as applied to renewable energy.

[Box 1 around here]

(ii) Enhancing technology transfer under the UNFCCC

Technology transfer was defined as a specific need within both the UNFCCC and Agenda 21 agreements of 1992. Much initial attention within the UNFCCC was conducted via the UNFCCC's Subsidiary Body on Scientific and Technological Advice (SBSTA), and the Clean Technology Initiative (CTI), which was established in 1995 with the cooperation of 22 OECD / International Energy Agency members. But approaches have often differed according to participants 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 argued that private companies own most environmentally beneficial technologies, and hence there is a need to create incentives for this kind of investment, and for the protection of intellectual property rights (in effect, a form of vertical technology transfer). 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 Intergovernmental 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 Marrakech 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 by failing to ensure that technology transfer (either horizontal or vertical) could be included as a pre-requisite in CDM projects as a matter of course.[1]

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

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[2]), including an inventory of environmental technology and projects. However, making contact with end users of technology has largely been left to socially concerned NGOs. In 2003, the UNFCCC (2003b:16) wrote: ‘governments can create enabling environments for technology diffusion and transfer if they endorse the importance of socially and environmentally oriented organizations and mandate social impact assessments for technology transfer projects.’ 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) also adopts a state-led perspective by writing ‘*transferring* experience, knowledge, skills and practices is “capacity building,”’ (emphasis added) which suggests that end users may not have pre-existing capacities that may 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. It wrote: ‘participatory development is now widely recognized as a way of achieving

[2] http://ttclear.unfccc.int/ttclear/jsp/

technology transfer at all levels of development endeavor' (IPCC, 2000:117[3]). 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[4]). This statement did not mention 'communities' or 'citizens' as key stakeholders.

Meanwhile, statements by UNEP have repeated the need for a participatory approach (UNEP, 2004:1). But similarly, statements so far have tended to illustrate 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) writes: '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 later, that, '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 statement 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

[3] McKenzie Hedger, M. and Martinot, E. (coordinating lead authors) 'Enabling environments for technology transfer,' pp.105-142 in IPCC (2000).
[4] Mansley, M. and Martinot, E. (coordinating lead authors) 'Financing and partnerships for technology transfer,' pp.143-174 in IPCC (2000).

next section how such partnerships between communities and private companies may emerge, in particular by reducing investors' costs, and increasing community governance of new technologies.

(iii) Enhancing partnerships between investors and communities

So, how can collaboration be enhanced between private investors and communities? Much discussion of public–private collaboration to date has focused on relationships between states and private companies, such as the common model of Build-Operate-Transfer (BOT) often used for infrastructure projects. As an alternative, public–private cooperation may be less formalized and more localized, and include negotiations, agreements, and task sharing between investors and public sector bodies such as local governments, NGOs, or citizen bodies. They may also include contracting with local enterprises that are too small to be considered large companies, but which nonetheless are representative of local communities. In principle, such partnerships offer 'win–win' solutions for investors and communities by reducing the costs of implementing new technologies, and by increasing local participation in defining technologies and their purposes. Such initiatives have been called 'civic environmentalism,' 'cooperative environmental governance,' or 'pro-poor public–private partnerships' (John, 1994; Glasbergen, 1998; Plummer, 2000; UNEP, 2000, 2004).

Localized, public–private partnerships have already been used as means of reducing problems with international investment in climate-friendly technologies. Collaboration with local citizens may reduce the costs of technology transfer by them to participate in the shaping of technologies implemented, or in identifying local needs. Moreover, economic cost sharing with citizens may offset costs if local civil groups perform certain tasks such as providing maintenance or financial management, or if the new investment provides complementary functions alongside local activities such as the collection local waste products for fuel for certain types of renewable energy. In eastern Indonesia, for example, the development agency Winrock has established new forms of decentralized electrification using wind turbines imported from the US, but where local non-governmental organizations and community-based organizations administer the projects by creating new institutions for financial and technical management (see Forsyth, 1999a:159).

Some insights into the structure of partnerships can be achieved from theories about collaboration between diverse actors (see Weber, 1998). As discussed above, investors want few technical barriers to investment; large consumer demand for their products; little resistance against 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) that ensure 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; historic trust of each party; and a shared or compatible perception of the underlying problem. Also, there may be different abilities to collaborate between other companies, and with local citizen groups.

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 health, safety or local economic development. Debates about 'cooperative environmental governance' (Glasbergen 1998) have argued that decisionmaking about environmental technology and investment should be characterized by clear – and unanimously agreed – objectives of investment and technology; the existence of clear and accountable negotiating arenas; and frequently help from government departments (such as environmental agencies) to provide environmental and technical information. Conceptually, these factors may be summarized as *trust and accountability.* Yet, despite much discussion of the need to consult 'communities' in environmental policy (e.g. UNEP, 2004), many social scientists have proposed 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 (e.g. Agrawal and Gibson, 1999). It is therefore difficult to allow local partnerships that include, or are trusted by, all citizens on an equal basis. In 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 suggested that few partnerships are conducted without some element of bias and co-optation of citizens: local elites may have links to businesses or government agencies (Evans, 1996). 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 have suggested that partnerships between citizens and investors may actually hide a variety of ways that reduce the ability for local citizens to influence investment. The following case studies present examples of collaboration, with special reference to the transaction costs, assurance mechanisms, and the trust and transparency of partnerships. These examples are then discussed to identify success factors for successful collaboration.

[Box 2 around here]

[Box 3 around here]

Collaboration in action: examples of waste to energy investment in the Philippines and Thailand

This paper uses waste-to-energy investment as its example of technology that may offer the ‘development dividend’ of both climate change mitigation and local development benefits (see IPCC, 2000:313-327). Waste management in developing countries is an urgent problem: municipal waste is growing, it is the source of disease and pollution, and it contributes to climate change by releasing methane through the decomposition of 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 therefore reduce waste, diminish greenhouse gases, and generate badly needed energy for industrialization.[5] Yet, critics have argued using waste for energy may encourage long-term unsustainability because planners will tolerate, rather than reduce, waste. Moreover, the choice of technology for waste-to-energy is important: incinerating municipal waste (including newer technologies such as pyrolysis[6]) emits potentially dangerous dioxins because it burns most waste material, including plastics. But biomethanation of municipal waste (also 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 through the Clean Development Mechanism, although critics are working to ban incineration of waste as a permissible 'climate-friendly' activity under this scheme.

Waste-to-energy is also a good illustration of partnerships between investors and citizens. Waste management in developing countries frequently involves a wide sector of society, from richer companies and neighborhoods, to the so-called 'waste pickers,' or citizens

[5] It should be noted that agricultural waste has been used for energy production for many years, either by incineration or biomethanation for biogas.
[6] Pyrolysis is a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. Pyrolysis typically occurs under pressure and at operating temperatures above 430°C (800°F).

who collect or recycle waste as their livelihood. Investors may also different between large and small transnational corporations, which may or may not specialize in waste treatment or renewable energies, and domestic companies who may have to compete with them. Investment in waste-to-energy therefore offers the possibility for partnerships of various forms between companies and communities, with or without the facilitation of the state or bilateral aid agencies. The case studies in this paper may therefore provide examples of both public–private collaboration, as a new means of climate technology transfer, and of investment that can benefit both local concerns and international climate change policy.

Thailand and the Philippines form good examples of recent experience in building waste to energy projects in Asia. The Philippines passed a Clean Air Act (2000) that banned the incineration of municipal waste, and a Solid Waste Act (2001) that mandates the separation of organic and inorganic waste at the household level, and hence facilitate waste treatment. (These reforms were influenced in part by campaigns by environmentalists such as the Philippines office of Greenpeace). Thailand to date has no similar national laws, yet the government has passed a ‘Small Producer Program ‘(SPP) and ‘Biomass Program’ to encourage the contribution of small electricity generators and biomass generation to the national grid. In common with many industrializing countries, tipping fees are rarely paid by citizens on a regular or high enough basis to allow the recovery of costs of urban or agricultural waste management. As a result, local governments need to seek alternative forms of cost recovery for waste management.

Thailand and the Philippines also represent different types of electricity business and potential markets for renewable energy or waste to energy projects. Box 4 summarizes some key differences between Asian countries for investment in renewable energy, and the relative positions of countries according to electricity supply and markets for renewable energy.

It should be noted that the examples described here present just ‘snapshots’ of current partnership and technology investment practices, and that practices will change in future years. Changes will occur as climate change becomes more important in influencing people’s lives, and as it becomes an increasingly legitimate policy concern within different arenas. The means of achieving public–private collaboration will also evolve over time as successful case studies become known, and governments, investors, and NGOs take action to create enabling environments for collaboration.[7]

[Box 4 around here]

(i) The importance of assurance mechanisms

Assurance mechanisms are contracts, laws, and expectations that ensure each side of a partnership will cooperate. Two examples from the Philippines and Thailand show the importance of these.

Between 2000-1, 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. The

[7] The research for this paper was conducted via a series of interviews and site surveys during the years 2001-2004. Representatives of investors, communities and relevant government bodies were questioned about specific examples and trends in climate change policy and collaboration.

region of Bulacan is one of the most important rice-growing zones 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 about the way Enron had organized its contracts for supplying rice husks. Enron 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. As a result, the rice millers quickly learned that Enron had no other suppliers of rice husks, and so could increase the price they wanted for the husks, and thus erode 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 was different to 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 supply of rice husks remained constant. For example, the investor made contracts with just 20-30 rice millers per power plant, rather than 150. Moreover, he sought to use just 10-15 percent of their total rice husk production, rather than 100 percent, as was the case in Bulacan. The power plants therefore experienced fewer transaction costs in dealing with fewer rice millers than in the Philippines, and did not rely on each miller sharing all of their rice husk production. Furthermore, millers are contracted to produce a guaranteed quantity of husks in a contract: producers 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, concerning which activities each partner is to take. Examples from the Philippines show the need to reduce costs with different partners.

Between 1996–1998, 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 investor used two techniques to reduce transaction costs and maximize revenue for itself. First, the company 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); plus 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 the waste into organic and inorganic waste. Segregating the waste in this was 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 failure was because 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 anticipated because the waste pickers and waste transporters were removing the most valuable elements of waste before they arrived at the plant. The company quickly decided that it was not possible for them to control the supply of recyclable waste, and so decided to waste recycling from its business objectives. The company 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 transaction costs – rather than let them increase 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 area of collaboration that maximize mutual benefits. The same US investor has later persisted with other biomethanation projects in the Philippines (notably in Baguio in Luzon, and

General Santos in Mindanao), where local people are hired in order to conduct waste sorting, but where the investor does not seek to restrict the local people from conducting 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. A local partnership is 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. Part of the local worry about the plant resulted from the misplaced belief that it would be owned by, or benefit, a local politician who has widespread influence over a variety of businesses. The discussion about the benefits or risks of the plant was therefore related to other debates between those who supported or opposed the politician.

In the Philippines, investors in biomethanation have also received opposition from national and international NGOs who are opposed to waste-to-energy in general. In the Philippines, 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 in order to reduce the vast production of waste that is now overloading the Philippines' cities, and to resist incineration of waste. But for many activists, this activism has also included opposition to biomethanation, even though it does not involve incineration, because few activists understand the process of electricity generation via anaerobic digestion, and because some activists believe any form of waste-to-energy is unacceptable because it legitimizes the production of waste. In the city of Baguio, in the northern island of Luzon, one US investor faced opposition from a local NGO who claimed that the biomethanation technology would remove people's livelihoods by preventing them from making compost.

There are, of course, many examples where political activism undermines 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 Biopwer undertook an extensive public education campaign, seeking to explain how rice husks would lead to electricity 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. After the disappointment at Suphan Buri, the company also took care to locate plants in sites that did not have the same reputation for political division.

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. In Ayala Alabang, near Manila, the American investor sought to avoid local resistance by hiring waste pickers to segregate waste. But after this proved to be unprofitable (because the pickers took the valuable waste for themselves), the company adopted different strategies of either not seeking ownership of recyclable waste at all, or of hiring waste pickers to do different jobs, such as operating machinery or organizing waste segregation.

The implications of these examples are that governing public happiness with partnerships between local people and investors can be very difficult, and be 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 have 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.

Conclusion: Lessons for capacity building for technology transfer

This paper has analyzed case studies of waste-to-energy investment in Thailand and the Philippines for two main reasons: to identify success factors underlying collaboration between private companies and communities to enhance climate technology transfer, and to seek examples of the so-called 'development dividend' – or where investment for climate change mitigation can also provide local development benefits. The paper focused on three key concepts of transaction costs, assurance mechanisms, and trust and accountability as determining factors of partnerships. Box 5 summarizes some of the key lessons for these factors concerning collaboration between companies and communities. Box 6 summarizes potential action points by different stakeholders, including the state (and for which, multilateral and bilateral aid agencies may also participate at each stage). These tables may assist in building long-term lessons for the evolution of partnerships within environmental policy as both climate change and pubic–private collaboration become more accepted as policy concerns in coming years. It should be noted, too, that this discussion in no way diminishes the need for continued attention to state-led technology initiatives, or research and development of technologies.

[Box 5 around here]

[Box 6 around here]

The paper draws three key lessons for enabling environments and capacity building for technology transfer as discussed under the UNFCCC. First, capacity building for technology transfer is not simply the extension of state services and information, but is also strengthening the ability for non-state actors to make agreements in ways that address mutual aims. The case studies from Thailand and the Philippines showed that various companies are keen to advance various technologies of waste-to-energy in ways that depend on some element of cooperation with local users. For both sides, the ability to reach agreements about (say) the supply of waste, or the livelihood benefits from power plants is the most important consideration for these actors. For this reason, the statement from the UNFCCC (2003a:4), that capacity building is '*transferring* experience, knowledge, skills and practices' is insufficient: capacity must be enhanced locally as well as transferred.

Second, technology transfer via non-state actors must not be described only in environmental or pubic-policy terms as an activity in its own right, but from the perspectives that make most sense to participants. As discussed at the start of this paper, 'technology transfer' is not something that private companies deliberately seek to do, but create as a by-product of leasing, contracting, or joint ventures with other collaborators. Similarly, many end users do not necessarily perceive technology transfer as attractive in its own right: they use different technologies for the other benefits of livelihood or lifestyle that they provide. In the examples from Thailand and the Philippines, disputes over technologies were sometimes dominated by other political concerns, such as concern at foreign investors or local politicians, rather than the details of the technologies themselves. Similarly, for investors, the possible achievement of climate change credits via the CDM was less attractive than achieving minimum transaction costs and long-term security of income (via power purchase agreements or similar assurance mechanisms). Facilitating these may be a more effective way of enhancing technology transfer via private investment than in assuming companies have an overt wish to conduct technology transfer for its own sake.

A third need for capacity building is to acknowledge that ‘communities’ are more diverse than 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 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 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.

These lessons might also influence the governance of the Clean Development Mechanism (CDM), concerning projects that invest in climate-friendly technologies. As discussed above, many developed countries have sought so-called ‘vertical’ forms of technology transfer (or the relocation and embedding of new technologies) when many developing countries have sought ‘horizontal transfer’ (or long-term technological upgrading and sharing of expertise). Enhancing the ability for local communities to participate in which technologies are transferred, and how, may allow a middle ground between vertical and horizontal forms of technology transfer that allow both security for investors and local benefits for hosts. Furthermore, resources from the CDM ‘adaptation fund’ may also be used to allow greater local participation in partnerships through funding activities listed in Tables 5 and 6. Allowing greater participation by communities in CDM projects may reduce the implication of the ‘adaptation fund’ that not all CDM projects may have a local development benefit, and hence increase local support and long-term success of CDM investment.

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. Learning from these examples may be an important step to implementing international environmental agreements more successfully, and in ensuring that environmental technology can be transferred quickly and effectively to industrializing countries.

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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/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 (1999a:204), after Stainforth and Staunton (1996), Gregory *et al* (1997)

Box 2: Conditions influencing the emergence and maintenance of collaboration

Transactions Costs of Alternative Decisions

The Assurance Mechanism

	High and applicable to all stakeholders	**High for most stakeholders but not all**	**Low**
None	1. No collaboration	2. No collaboration	3. No collaboration
Partial	4. Collaboration possible, but not sustainable	5. Highly unlikely	6. No collaboration
Full	7. Sustained collaboration	8. Collaboration possible, but not sustainable	9. No collaboration

(Source: Williamson, 1985; Weber, 1998:34)

Box 3: Successful collaboration through transaction cost savings and assurance mechanisms

Transaction cost savings	The Assurance Mechanism	
Stakeholders anticipate:	Transaction-specific conditions:	Keys to reducing uncertainty:
– reduced scope and incidence of litigation	– the opportunity exists to develop creative compromises	– entrepreneurial political leadership
– faster environmental progress through reduced legislative gridlock and implementation delays	– there are a limited number of related issues	– public sector organization's reputation of commitment to collaboration and fairness
– minimizing information asymmetries favoring industry and states	– policy implications of issues to be resolved are more or less limited either programmatically, geographically, or by common practices in a specific industrial sector	– formal binding rules to govern the negotiation process and its aftermath
– greater cost effectiveness of regulatory instruments; compliance cost savings for industry	– affected interests are identifiable, relatively few in number, and cohesive	– degree of inclusiveness
– greater planning and investment certainty for industry and states	– does not involve fundamental values that cannot be compromised	– participants' involvement in pollution control issues are long-term and iterative
– accelerated rates of technological innovation (more options in battle against pollution)	– there is a well-developed factual database to frame the discussion and resolution of pertinent issues	
– increased certainty of environmental results (more rigorous monitoring, focus on real environmental results rather than rule-based proxies)	– there are firm deadlines, either statutory, judicial, or programmatic	

(Source: Weber, 1998:13)

Box 4: Summary of markets for renewable energy in Asia according to competition from fossil fuels, government policy, and business structure

Mostly grid connected ← ··· → *Mostly off-grid technology*

FDI mostly unrestricted access / private ownership encouraged ↑ ··· ↓ *FDI mostly heavily regulated/ privatisation undeveloped*

Investment tending towards vertical integration ↑ ··· ↓ *Investment tending towards horizontal integration*

Category 1 (example: Thailand) • limited investment in stand-alone off-grid technologies • investment grid-connected RET encouraged through SPPs laws • DSM is higher government priority	**Category 4** (example: Philippines) • government incentives for decentralised RET • local investment aided by intermediary organisations and local participation • good trading links with manufacturing countries
Category 2 (example: Vietnam) • initial stages of privatisation and energy-sector development • little government incentives or structures for investment in RET • some success from intermediary organisations using well-established social networks	**Category 3** (example: Indonesia) • investment slowed by negotiations with bureaucracies • off-grid schemes need long-term commitment and financial education • some encouragement for grid-connected supply by PSKSK laws

High competition from fossil fuels ← ··· → *Low competition from fossil fuels*

Source: Forsyth (1999a)

Box 5: Critical Success Factors for Partnerships between Investors and Communities for Technology Transfer

Minimize transaction costs. Transaction costs are the costs of interaction that can make or break a partnership. At the most obvious level, this means keeping projects feasible and small scale. Enron's failed rice husk project in Bulacan, Philippines, failed because it sought to generate 40MW, and consequently had to contract with too many suppliers. But AT Biopower in Thailand has proven that smaller plants (of 16MW) can work. Transaction costs also imply that investors should decide where profits lie, and when to leave other activities to communities. For example, in the Philippines, investors in biomethanation realized that transaction costs would be reduced once clear boundaries were established around the ownership and participation in the waste treatment process.

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 honored 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). Successful assurance mechanisms also mean reduced transaction costs, as both sides have incentives to perform.

Maximize trust and accountability. Trust and accountability indicate the extent to which participants, and especially communities, perceive partnerships as acceptable. Sometimes this means accepting that local social and political contexts may shape how technology diffusion is seen. These factors may also include local or national political or environmental activism. In the central plains of Thailand, some citizens wrong interpreted the proposed power plant as related to local political conflicts, and hence opposed it. 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. Maximizing trust and accountability also enhances assurance mechanisms and reduces transaction costs, and is a role that governments can play.

Box 6: Building capacity for climate technology transfer via public–private cooperation

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 programs for building investment in renewable energy technologies such as Thailand's Small Producer Program and Biomass Program, which offer an initial subsidy for plants to invest in new technologies for using 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 of how cooperation may benefit all parties if conducted in acceptable ways.