Analysis of Technology Transfer in CDM Projects

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Abstract

Although the Clean Development Mechanism (CDM) does not have an explicit technology transfer mandate, it may contribute to technology transfer by financing emission reduction projects using technologies currently not available in the host countries. This report analyzes the claims of technology transfer made by project participants in the project design documents for 3296 registered and proposed CDM projects. Roughly 36% of the projects accounting for 59% of the annual emission reductions claim to involve technology transfer. Technology transfer is more common for larger projects and projects with foreign participants. Technology transfer is very heterogeneous across project types and usually involves both knowledge and equipment. The technology originates mostly from Japan, Germany, the USA, France, and Great Britain. The rate of technology transfer is significantly higher than average for several host countries, including Bolivia, Ecuador, Guatemala, Honduras, Indonesia, Kenya, Malaysia, Mexico, Pakistan, South Africa, Sri Lanka, Thailand and Vietnam and significantly lower than average for Brazil, China, and India. As the number of projects increases, technology transfer occurs beyond the individual projects. This is observed for several project types in China and Brazil. For most project types, project developers appear to have a choice among a number of domestic and/or foreign technology suppliers.

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1 Introduction

Technology development and transfer is included in both the United Nations Framework Convention on Climate Change and its Kyoto Protocol. Article 4.1 of the Convention requires all Parties to promote and cooperate in the development, application and diffusion, including transfer, of GHG mitigation technologies.[1] Articles 4.3 and 4.5 stipulate that developed country Parties should provide new and additional financial resources to support the transfer of technology and take all practicable steps to promote, facilitate and finance the transfer of, or access to, environmentally sound technologies and know how to developing country Parties. Article 11.1 of the Convention further prescribes that financial resources shall be provided for the transfer of technology on a grant or concessional basis.

The Kyoto Protocol, in Article 10(c), reiterates the requirement of all Parties to cooperate in the development, application, diffusion and transfer of environmentally sound technologies that are in the public domain.[2] Article 11.2 of the Protocol repeats the commitment of developed country Parties to provide financial resources for technology transfer.

Initiatives to fulfil these commitments include creation of an Expert Group on Technology Transfer to provide advice to Parties, establishment the Technology Information Clearing House (TTClear) by the Climate Change Secretariat, and preparation of technology needs assessments (TNAs) by many developing country Parties.[3] A country TNA involves stakeholders in a consultative process to identify technology needs by sector, barriers to technology transfer and measures to address these barriers.

Although the Clean Development Mechanism (CDM) does not have an explicit technology transfer mandate and is not identified as a means of fulfilling the technology transfer objectives of the Protocol, it may contribute to technology transfer by financing emission reduction projects that use technologies currently not available in the host countries. This paper examines the technology transfer claims for CDM projects.

Section 2 provides background on technology transfer and the Clean Development Mechanism. Data sources are presented in section 3. The results of the analyses are presented in sections 4 through 14. Conclusions are provided in section 15.

2 Background

2.1 Technology Transfer

In its Special Report on Methodological and Technological Issues in Technology Transfer, the Intergovernmental Panel on Climate Change (IPCC) defines technology transfer "as a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions."[4]

This definition covers every relevant flow of hardware, software, information and knowledge between and within countries, from developed to developing countries and vice versa whether on purely commercial terms or on a preferential basis. The IPCC acknowledges that "the treatment of technology transfer in this Report is much broader than that in the UNFCCC or of any particular Article of that Convention."[5]

This paper analyzes the claims of technology transfer made by CDM project participants in their project design documents (PDDs). In Section A.4.3 of the project design document, "technology to be employed by the project activity", the project participants are requested to "include a description of how environmentally safe and sound technology and know-how to be used is transferred to the host Party(ies)."[6] The CDM glossary of terms does not define "technology transfer".[7]

Since the analysis covers 3296 registered and proposed projects, it is not practical to define "technology transfer" and then ensure that all claims are consistent with that standard definition. Rather the analysis reflects the definitions implicitly adopted by project participants when they prepare their PDDs. However, it can be inferred from the information in the PDDs that project participants almost universally interpret technology transfer as meaning the use by the CDM project of equipment and/or knowledge not previously available in the host country. The arrangements for the technology transfer, whether on commercial or concessionary terms, are never mentioned.

In summary, the technology transfer claims are not based on an explicit definition but generally assume that technology transfer means the use of equipment and/or knowledge not previously available in the host country by the CDM project. Several of the projects reviewed claimed technology transfer for technology already available in the country. Since the focus of the Kyoto Protocol is on technology transfer between countries, those cases were classified as involving no technology transfer.

2.2 CDM Projects

The participants must complete a project design document that describes the proposed CDM project. An independent "designated operational entity" (DOE) must validate a proposed project to ensure that it meets all of the requirements of a CDM project. As part of the validation process the DOE must solicit public comments on the proposed project. Once public comments are requested for a project it is considered to be in the CDM pipeline. This paper analyzes the technology transfer claims in the project design documents of 3296 projects in the CDM pipeline as of June 2008, of which over 1000 had been registered by the CDM Executive Board.

The 3296 proposed projects include 26 different categories of greenhouse gas emission reduction actions (project types). The analysis investigates whether the percentage of projects for which technology transfer is claimed varies by project type. A CDM project may be implemented by project participants from the host country alone – a "unilateral" project – or jointly with foreign participants. Small projects may use simplified baseline and monitoring modalities.[8] The analysis investigates whether the incidence of technology transfer claims differs for unilateral and small-scale projects.

The characteristics of the host country might affect the incidence of technology transfer for CDM projects. A larger (larger population or larger economy) host country might already use a technology and/or have the expertise for a given project type. Similarly, a richer host country, higher per capita GDP, might already use a technology and/or have the expertise for a given project type. The analysis investigates whether the incidence of technology transfer claims is affected by such host country characteristics.

A host country can incorporate technology transfer requirements into its criteria for approval of CDM projects. In addition, host country characteristics, such as tariffs or other barriers to imports of relevant technologies, perceived and effective protection of intellectual property rights, and restrictions on foreign investment, can have an impact on technology transfer. The analysis investigates whether technology transfer differs significantly across host countries.

The report analyses the origins of the transferred technologies – equipment, knowledge, or both – by project type. Trends in the transfer of technology through CDM projects are examined. Finally, potential market power on the part of technology suppliers is examined in terms of the number of countries that supply technology for each project type and the share(s) of the technology supplied by the largest supplier(s) for each project type.

3 Data Sources

The primary source of data on CDM projects is the "CDM_Projects" sheet of *The CDM Pipeline* for June 2008 (Fenhann, 2008).[9] It lists, inter alia, the host country, the project type based on 26 categories,[10] the methodology used, the estimated annual emission reductions, and the countries that have agreed to buy credits generated by the project for each of 3296 registered and proposed projects covered by this analysis. Small-scale projects are identified from the methodology used.[11] Projects with no credit buyer are classified as "unilateral" projects.

Information about technology transfer had to be collected from the individual Project Design Documents (PDD). Statements relating to technology transfer were generally found in sections A.4.2, A.4.3 or B.3 of the PDD. To ensure that all statements relating to technology transfer were identified each PDD was searched for several keywords related to technology transfer.[12] In many cases the PDD explicitly states that the project involves no transfer of technology. For other projects, the PDD makes no mention of technology transfer.

Where claims for technology transfer are made, they were coded for the nature of the technology transfer activity (imported equipment, training local staff, etc.). The codes distinguish transfer of both equipment and knowledge from transfer of equipment or knowledge alone. In addition to the nature of the technology transfer, the source countries were recorded. If the source was not identified, the project's developers were contacted to determine the origins of the technology. Often the source is not known because the technology supplier for a proposed project has not yet been selected, so the source remains "unknown" for about 20% of the projects that claim technology transfer.

Data on the population and GDP of each host country were obtained from the Climate Analysis Indicators Tool (CAIT) (World Resources Institute).[13] The population and GDP are for 2000, with GDP being converted to international dollars using purchasing power parity (PPP) exchange rates. The data come from the 2003 *World Development Indicators* report prepared by the World Bank. The GDP is divided by the population to get the GDP per capita for each host country.

Host countries were grouped into size categories based on population. Host countries were also classified into the per capita income categories – Least Developed Countries, Other Low-Income Countries, Lower Middle-Income Countries, and Upper Middle-Income Countries – defined by the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD, 2005).

4 Technology Transfer by Project Type

Table 1 shows the number of projects and average project size (estimated annual emission reductions) by project type. It also shows the percentage of the projects and of the estimated annual emission reductions for which technology transfer is claimed. The distribution of projects is not uniform: about one-third of the project types have fewer than 10 projects while another third have over 100 projects each, with Biomass energy, Hydro and Wind dominating the totals. The average project size varies widely across categories from 10 ktCO_2e per year for Energy efficiency service to 4,305 ktCO_2e per year for HFC reduction projects. The overall average is 144 ktCO_2e per year.

The percentage of projects that claim technology transfer averages 36% and ranges from 0% to 100% for different project types. That is easy to understand when a category includes only a single project, as in the case of Tidal and CO_2 capture, but large differences are observed for project types with relatively large numbers of projects as well. Only three of the 35 Cement projects and 67 of the 856 Hydro projects claim technology transfer, while 159 of the 172 Agriculture projects, 17 of the 19 HFC destruction projects and 56 of the 59 N_2O destruction projects claim to involve technology transfer.

Projects that claim some technology transfer represent 59% of the estimated annual emission reductions.[14] Since this is much higher than the 36% of projects that claim technology transfer, it indicates that projects that claim technology transfer are, on average, substantially larger than those that make no technology transfer claim. This is true for most project types as well. However, the Afforestation, Fugitive emission reduction, Solar and Transport projects that claim technology transfer are much smaller than similar projects that do not claim technology transfer, while the Agriculture, Cement and Reforestation projects that claim technology transfer are a little smaller, than the averages for those categories.

Technology transfer claims for unilateral and small-scale projects by project type are summarized in Table 2. Over 39% of all projects are unilateral projects, but they account for only about 21% of the annual emission reductions.[15] This means that the average size of unilateral projects, 79 ktCO_2e/yr, is a little more than half that of all CDM projects. About 30% of the unilateral projects claim technology transfer as compared to 36% of all projects. The projects that do claim technology transfer are somewhat larger than the average for unilateral projects, accounting for 40% of the emission reductions.

Conversely, the projects that have foreign participants are almost 30% larger (184 ktCO_2e/yr) than the average for all CDM projects.[16] Around 40% of the projects that have foreign participants, representing 64% of the estimated emission reductions for those projects, claim technology transfer. Thus technology transfer claims are more common for projects that have foreign participants and the projects that claim technology transfer are larger than those that do not claim technology transfer.

Small-scale projects represent 45% of all projects.[17] Small-scale projects, by definition, are much smaller than average (42 ktCO_2e/yr). About 30% of the small-scale projects claim technology transfer as compared to 36% of all projects. The average size of projects that claim technology transfer is approximately the same size as the average for projects that do not claim technology transfer.

In summary, technology transfer is more common for larger projects; 36% of all CDM projects accounting for 59% of the annual emission reductions involve technology transfer.

Technology transfer varies widely across project types. Technology transfer is more common for projects that have foreign participants, possibly because those projects tend to be larger. Unilateral and small-scale projects involve less technology transfer, possibly due to their smaller size. Within any given group – foreign participants, unilateral, small-scale – technology transfer is more common for larger projects.

5 Technology Transfer by Host Country Characteristics

Do CDM projects in larger or richer countries draw upon a larger, more diverse stock of technology in the host country and so involve less technology transfer? The data in Table 3 address that question.

There doesn't appear to be a direct link between technology transfer and country size. Technology transfer claims, in terms of share of projects and share of annual reductions, are more common for CDM projects in countries with a population up to 100 million. Projects in both smaller and larger countries claim less technology transfer.

Likewise, there does not appear to be a systematic relationship between a host country's per capita GDP and technology transfer. The frequency of technology transfer claims is high for "Least Developed Countries" "Upper Middle Income" and "Other" countries. The frequency of technology transfer claims is quite low for "Other Low-Income Countries". India accounts for almost 93% of the projects and over 82% of the annual emission reductions for this group.

In short, technology transfer does not appear to be systematically related to the host country population or per capita GDP. The characteristics of projects in some countries, such as India and South Korea, affect technology transfer for the categories that include those countries. The next two sections examine technology transfer claims for projects in specific host countries in more detail.

6 Technology Transfer for Selected Host Countries

Each CDM project must be approved by the host country government. As part of its approval process the host country government may choose to impose technology transfer requirements. Table 4 presents data on technology transfer claims for every country that accounts for more that 2% of the number of projects or 2% of the total annual emission reductions. Four countries – Brazil, China, India and South Korea – dominate the totals, accounting for 72% of the projects and almost 80% of the annual emission reductions.

According to the *Brazilian Manual for Submitting a CDM Project to the Interministerial Commission on Global Climate Change*, the project developer shall include in the description of the project its contribution to sustainable development including its "d) contribution to technological development and capacity-building."[18] Technology transfer is not mentioned directly. Rather the project's contribution to technology development is assessed as part of its contribution to sustainable development. Technology transfer for Brazilian projects is a little below the average for all CDM projects measured in share of projects (28% vs 36%) and annual emission reductions (57% vs 59%)(see Table 4).

In *Measures for Operation and Management of Clean Development Mechanism Projects in China*, the Government of China requires that "CDM project activities should promote the transfer of environmentally sound technology to China."[19] This is a general provision not a mandatory requirement for each project. Projects in China involve a rate of technology transfer a little lower that the average for all CDM projects measured in share of projects (28% vs 36%) and equal to the average for annual emission reductions (59% vs 59%) (Table 4).

In the *Eligibility Criteria* for CDM project approval established by the Indian Government, it is prescribed that the "Following aspects should be considered while designing [a] CDM project activity: … 4. Technological well being: The CDM project activity should lead to transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in upgradation of the technological base. The transfer of technology can be within the country as well from other developing countries also."[20]

The Indian Government has adopted a broad concept of technology transfer, similar to that of the IPCC special report, which includes technology transfer *within* the country. However, technology transfer within a country, claimed by seven Indian projects, is excluded from this analysis. India has a much lower rate of international technology transfer than average whether measured in terms of number of projects (16% vs 36%) or annual emission reductions (41% vs 59%) (Table 4). The projects that claim international technology transfer are larger than the Indian average.

The Korean Designated National Authority for the CDM requires that "environmentally sound technologies and know how shall be transferred."[21] Projects in Korea are much larger than the average for all CDM projects and are more likely to claim technology transfer. About half of the projects in Korea representing 82% of the annual emission reductions claim technology transfer (Table 4).

Clearly, a host country can influence the extent of technology transfer involved in its CDM projects. It can do this explicitly in the criteria it establishes for approval of CDM projects. Other factors, such as tariffs or other barriers to imports of relevant technologies, perceived and effective protection of intellectual property rights, and restrictions on foreign investment also can affect the extent of technology transfer involved in CDM projects. In most host countries technology transfer is more common for larger projects.

7 Regression Analysis with Project Type and Host Country

Regression analysis can be used to examine relationships between technology transfer and combinations of project characteristics, host country characteristics and the host country. Essentially, regression analysis should reveal whether technology transfer is more or less likely to occur for a given combination of such variables. For example is technology transfer more likely for larger projects regardless of the project type, is technology transfer more / less likely for a given project type regardless of size, is technology transfer more / less likely for a given host country regardless of the project characteristics? The details of the regression analysis are explained in Annex A and the results are presented in Table 5.

The regression results (equation 3 in Table 5) indicate that technology transfer is more common as project size increases regardless of project type and host country. Technology transfer is less common for unilateral projects – more common for projects with foreign participants – regardless of the project characteristics or host country.

Agriculture, HFC, Landfill gas, N_2O and Wind projects are *more likely* to involve technology transfer regardless of the project characteristics. Conversely, Biomass, Cement, Fugitive, Hydro and Transport projects are *less likely* to involve technology transfer regardless of the project characteristics. This can be interpreted as a preference for local technology for these project types.

The 3296 projects are located in 67 host countries. Projects located in the 41 host countries listed in Figure 1 were excluded from the regression analysis for one of two reasons. Countries that yield a perfect prediction – all projects in the country claim or do not claim technology transfer – must be dropped from the regression estimation for statistical reasons. The 22 host countries in this category typically have only one project. Also, to eliminate the effects of collinearity, the projects in countries with an insignificant "z" statistic are also excluded from the regression estimation.[22] Technology transfer is neither *more* or *less* likely for the projects in the 19 countries in that category. The regression analysis was then performed using the projects for the remaining 26 host countries.

Figure 1

Perfect predictions	Insignificant "z"
Bangladesh	Argentina
Cambodia	Armenia
Cuba	Chile
Dominican Republic	Colombia
Fiji	Egypt
Georgia	El Salvador
Guyana	Ivory Coast
Kyrgyzstan	Jamaica
Lao PDR	Morocco
Macedonia	Nepal
Malta	Nicaragua
Mauritius	Panama
Mongolia	Tanzania
Nigeria	Uruguay
Papua New Guinea	Azerbaijan
Qatar	Congo
Senegal	Jordan
Mozambique	Mali
Singapore	United Arab Emirates
Tajikistan	
Tunisia	
Uganda	

Technology transfer is *more* likely for projects in Bolivia, Ecuador, Guatemala, Honduras, Indonesia, Kenya, Malaysia, Mexico, Pakistan, South Africa, Sri Lanka Thailand and Vietnam. Technology transfer is *less* likely for projects in Brazil, China, and India. The results are consistent with the rate of technology transfer for the host countries in Table 4. The reasons for the low rates of technology transfer for Brazil, China and India are examined in Section 13 below.

8 Nature of the Technology Transfer

Determining the nature of a technology transfer from a wide variety of written statements inevitably involves judgments. We tried to reflect the written statements in the PDDs as accurately as possible and, when a technology transfer occurred, assign it to one of the four categories in Table 6, that is the transfer of equipment only through import, the transfer of knowledge only through training and the engagement of foreign experts, the transfer of both equipment and knowledge, and other. The first three categories are self evident and the nature of the technology transfer from individual statements within the PDDs fell into one of those three quite readily. There were seven projects, however, that involved the development of a new technology under a domestic and foreign partnership. These were classified as "Other".

Several PDDs claimed a technology transfer from one region to another within the same host country. These are fair claims since there is no guidance on what constitutes a technology transfer. But the focus of this analysis is international technology transfers, so those projects were classified as not involving technology transfer.

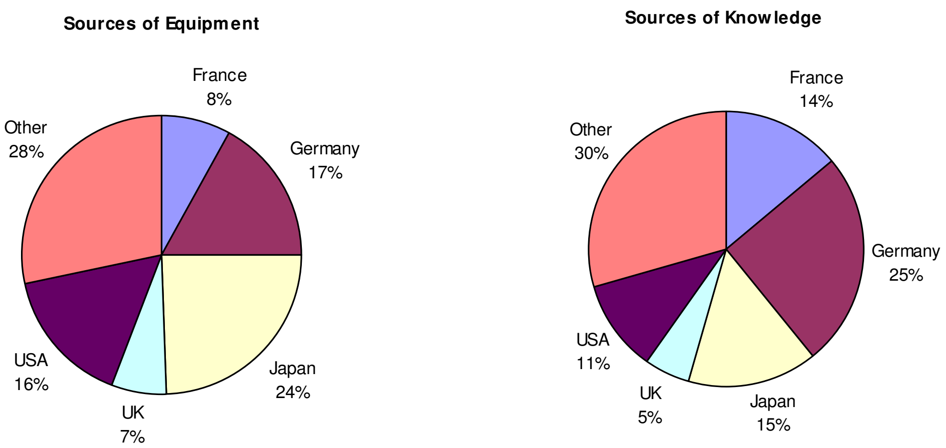
More than half (53%) of the projects that involve technology transfer claim both equipment and knowledge transfers, and account for 47% of the emission reductions. About one-third of the projects that claim technology transfer involve only equipment imports, but those projects account for 38% of the emission reductions. Transfers of knowledge alone involve 15% of the projects accounting for 15% of the emission reductions.

9 Origin of the Technology

Where does the technology come from? To answer this question the country providing the technology for a project was credited with the estimated annual emission reductions of the project. If more than one country supplied technology to a project, the estimated annual emission reductions were divided equally among the countries involved. For projects that involved a transfer of both equipment and knowledge, half of the estimated annual emission reduction was attributed to the knowledge suppliers and half and to the equipment suppliers. So a project with expected annual emission reductions of 100 ktCO_2e per year with three countries supplying equipment and two supplying knowledge would be counted as 16.7 ktCO_2e per year for each of the equipment suppliers and 25 ktCO_2e per year for each of the knowledge suppliers.

Many PDDs identify a technology transfer, but do not specify the source of the technology. If the source was not identified, the project's developers were contacted to determine the origins of the technology. The source of the technology remains "Unknown" for about 20% of the projects that claim technology transfer. This is, at least partly, due to projects for which the technology has not yet been sourced because the project has not yet been implemented yet. The sources of the technology transferred through CDM projects are shown in Figure 2.

Figure 2



When projects for which the source of the technology is "unknown" are excluded, 94% of the equipment and 98% of the knowledge transfer comes from Annex I countries (including USA). While a relatively large number of countries are identified as sources of technology, five countries are the sources for over 70% of the transfer of equipment or knowledge; Japan, Germany, the USA, France, and Great Britain.

Although technology transfer from Non-Annex I countries is less than 10% of all technology transfer, five countries figure prominently; Brazil, China, India, South Korea and Chinese Taipei are the source of 94% of equipment transfers and 70% of knowledge transfers from Non-Annex I sources.

10 Technology Supply and Credit Purchases

Is technology supply related to credit purchases? A technology supplier might agree to purchase / accept some of the credits from the project for example. That issue is analysed for the five largest technology suppliers (the USA was excluded from the analysis as there are no instances where it is a credit buyer). Figure 3 shows the estimated annual emission reductions for which those countries are technology suppliers and credit buyers.

The data in the diagonal cells are projects where a country is both the technology supplier and a credit buyer. The data indicate that France is not a credit buyer for any of the projects that use French technology. German technology is used for about 42% of the projects (based on estimated annual emission reductions) from which it purchases credits. The UK purchases credits from about 66% of the projects to which it supplies technology.[23] Japan has the closest relationship between credit purchases and technology supply; it buys credits from 44% of the projects to which it supplies technology and 67% of its credit purchases come from projects for which it is a technology supplier.

Figure 3
Relationship between Technology Supply and Credit Purchases for Japan, Germany, France, and the UK
(estimated annual emission reductions, $ktCO_2e$)

Country buyer	Technology Supplier					
	France	Germany	Japan	UK	Other	Grand Total
France	**-**	184	136	-	1,554	1,874
Germany	-	**2,056**	673	212	1,885	4,826
Japan	45	1,572	**13,699**	439	4,625	20,380
UK	3,783	11,382	14,303	**3,696**	23,534	56,699
Other	10,912	5,755	2,711	1,247	28,024	48,649
Grand Total	14,741	20,950	31,523	5,595	59,622	132,429

In summary, a significant share of the credit purchases by Japan (67%) and Germany (42%) come from projects to which they supply technology. The UK buys credits from a significant share (66%) of the projects to which it supplies technology.

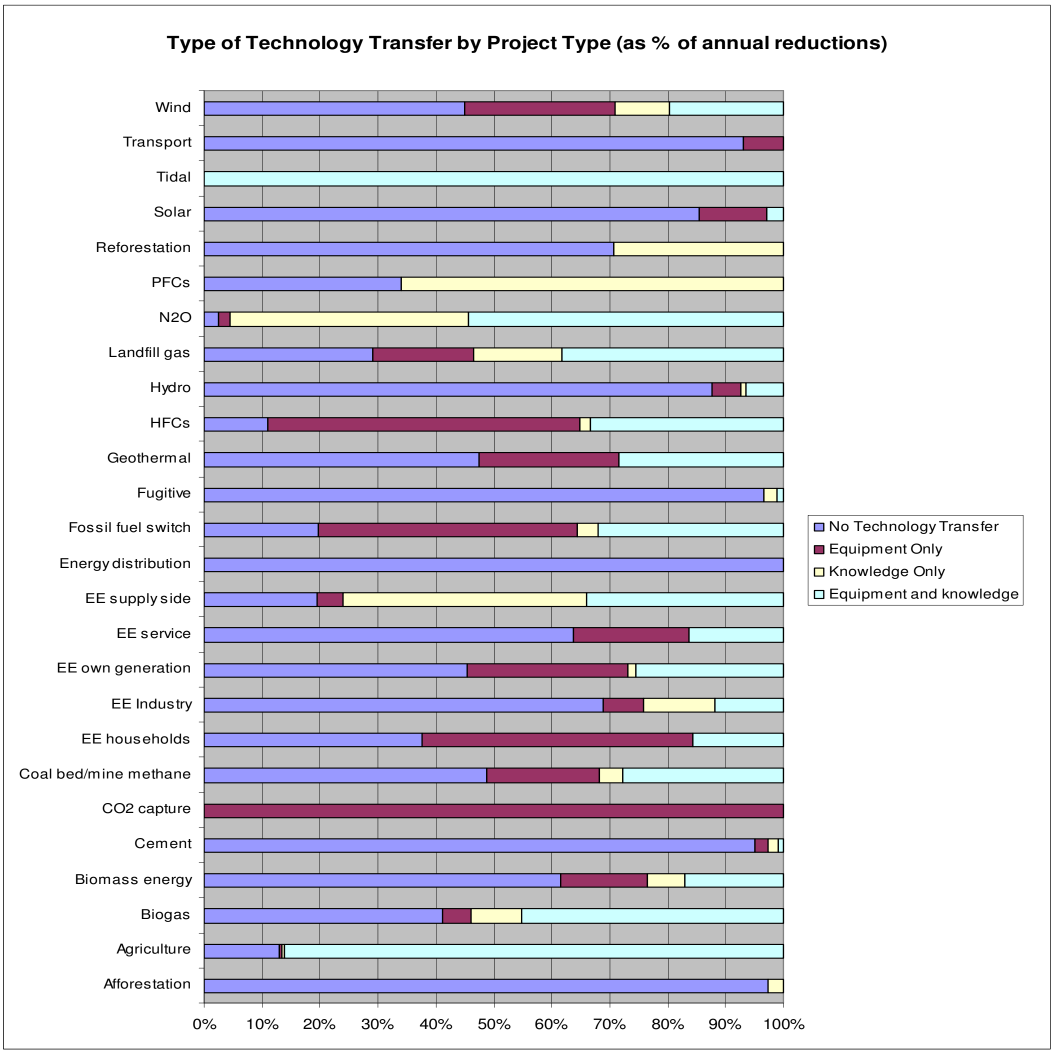
11 Technology Transfer by Project Type

As noted earlier (Table 1) the frequency of technology transfer claims varies widely across project types. Thus the nature of the technology transfer and the sources of the technology are also likely to vary by project type. The nature of the technology transfer – equipment only, knowledge only, or both – by project type is summarized in Table 7. There is no obvious pattern to the nature of the technology transfer by project type.

Tables 8, 9 and 10 show the expected annual emission reductions for each project type by technology supplying country for equipment transfers only, knowledge transfers only and transfers of both equipment and knowledge respectively. Due to the amount of data in these tables, it is difficult to discern any underlying patterns if there are any.

Figure 4 shows the share of technology transfer claims and the nature of the technology transfer claims by project type.

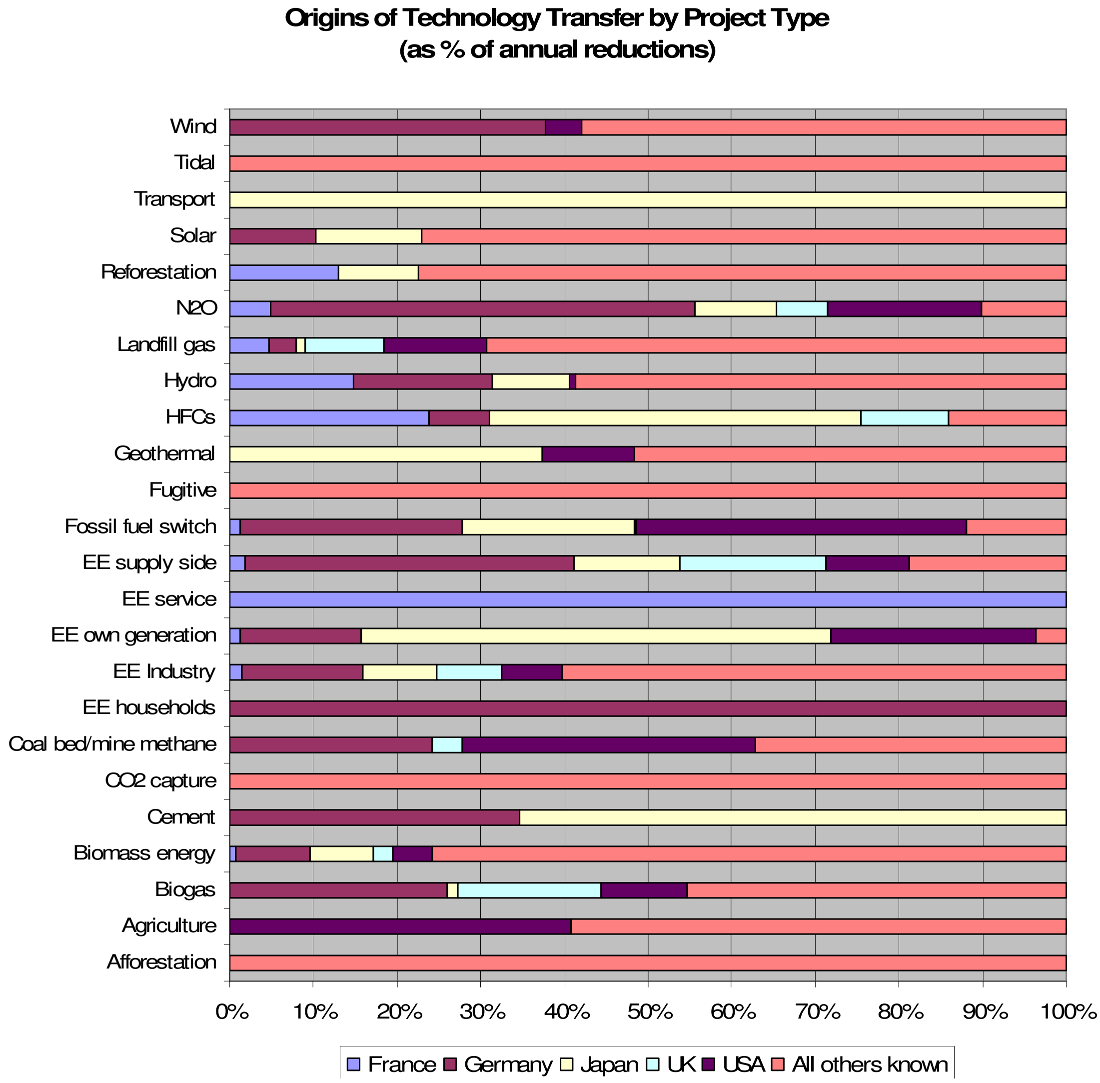
Figure 4
Type of Technology Transfer by Project Type



Relatively few Cement, Fugitive, Hydro, Reforestation and Transport projects claim technology transfer. Large shares of the EE Households, Fossil fuel switch and HFC projects involve imported equipment. To a lesser extent, Wind, Geothermal, Coal bed methane and EE Own generation tend to import equipment only as well. Transfer of knowledge is particularly important for Reforestation, N_2O and EE Supply side projects. Equipment and knowledge is most common for Agriculture, Biogas, N_2O and Landfill gas projects. For Afforestation, CO_2 Capture, EE Service, Energy distribution, PFCs and Tidal projects the number of projects is too small to draw robust patterns.

Figure 5 shows the sources of the technology by project type. Most project types draw on technology from several countries. Japan is the dominant supplier of technology for Geothermal, EE Own generation, HFC and Transport projects. Germany is the dominant supplier for EE Households, EE Supply side and N_2O projects.

Figure 5
Origins of Technology Transfer by Project Type



12 Diversity of Technology Supply by Project Type

A large market share for a few technology suppliers might indicate that the technology is controlled by a few sources, an oligopoly, that could restrict the distribution of the technology and / or keep the price relatively high. The data in Table 11 focus on this issue. The table presents the number of supplier countries and the shares of the largest supplier country and four largest supplier countries as percentages of the annual emission reductions for projects that claim technology transfer and for which the technology supplier is known.

Three project types – Afforestation, CO_2 Capture, Tidal and PFC destruction – have either a single project or no project that claims technology transfer. Four project types – EE

Households, EE Service, Fugitive and Transport – have only one technology supplier country with a 100% share. For each of these project types, the number of projects is too small to assess whether the industry that supplies the technology imposes barriers to technology transfer for any of these project types.

Project types with a large market share (over 50%) for the largest supplier include Cement, EE Own generation, N_2O, Reforestation and Solar. In the case of Cement only three out of the 35 projects claim technology transfer, so a large market share for the largest supplier is not surprising, but might not be a concern given that most projects do not involve technology transfer. For Reforestation and Solar projects, the largest supplier countries have a market share of 77%, but the total number of projects in these categories is relatively small. EE Own generation and N_2O each include at least 50 projects that claim technology transfer. The number of known technology supplier countries is 6 and 9 respectively. But the largest supplier country has a market share of just over 50%. Whether that is due to the concentration in the relevant technology supply industries, replication of similar projects, or other reasons warrants further investigation.

All of the other project types – Agriculture, Biogas, Biomass energy, Coal bed/mine methane, EE Industry, EE Supply side, Fossil fuel switch, Geothermal, HFC destruction, Hydro, Landfill gas, and Wind – have at least 6 known supplier countries and a market share of less than 45% for the largest supplier suggesting the suppliers do not impose barriers to transfer of the technologies for these project types.[24]

In summary, thirteen of the project types have at least ten projects that claim technology transfer. All of these project types have at least six known foreign supplier countries; some have over 20 supplier countries. For all of these project types except EE Own generation and N_2O the market share of the largest supplier country is less than 50%. Further investigation of the reason(s) for the large market share of the dominant foreign technology supplier for EE Own generation and N_2O is warranted. For the project types with sufficient projects, project developers appear to have a choice among a number of domestic and/or foreign suppliers with no dominant supplier able to restrict the distribution of the technology and/or keep the price high. For the other project types the number of projects is too small to infer whether barriers to technology transfer might exist.

13 Trends in Technology Transfer

Technology transfer claims have been analysed for groups of registered projects (De Coninck, et al., 2007; Dechezleprêtre, et al., 2007) and for 854 (Haites, et al., 2006), 2293 (Seres, 2007) and 3296 (this report) proposed and registered projects. The last three analyses find that 35% to 40% of the projects, representing roughly 59% to 66% of the estimated annual emission reductions, claim to involve technology transfer. This stability is surprising, given the changes in the mix of CDM projects in the pipeline.

Initially, the emission reductions were dominated by a small number of large HFC and N_2O projects and Landfill gas projects. As the potential for the HFC projects Coal mine/bed methane joined N_2O and Landfill gas as the major sources of emission reductions. Over the last year EE Own generation,[25] Fossil fuel switch, Hydro, and Wind have become more prominent in terms of estimated emission reductions. Biomass energy projects have become less common recently. All of those project types, except Fossil fuel switch and Hydro, involve high rates of technology transfer.

The regression analysis reported in Section 7 above indicates the three largest host countries – China, India and Brazil – all have significantly less technology transfer taking into account project characteristics. This is a consistent result for India. But China moved from having significantly more technology transfer for the first 854 projects and Brazil moved from having no significant impact on technology transfer for the first 854 projects. Two approaches were used to better understand these developments.

First, following Dechezleprêtre, et al., an additional variable was introduced into the regression analysis.[26] That variable (Trend) is the number of previous projects of the same type in the host country.[27] The regression results that include this variable are presented in Table 13.[28] The Trend variable is highly significant with a negative coefficient, indicating that as more projects of a given type are implemented in a country the rate of technology transfer declines. This indicates a transfer of technology beyond the individual CDM projects that allows later projects to rely more on local knowledge and equipment.

Second, the share of projects that claimed technology transfer was examined over time by project type for China, India and Brazil. China and Brazil show a strong downward trend in the share of projects and share of annual reductions that claim technology transfer from the first 854 projects to the last 1003 projects (see Table 14). For China the three of the five project types with 20 or more projects each – EE Own generation, N_2O and Wind – show declining rates of technology transfer over time as more projects are developed while Fossil fuel switch and Landfill gas show no trend.[29] For Brazil two of the three project types with 10 or more projects each – Biomass energy and Landfill gas – show declining rates of technology transfer as more projects are developed, while Agriculture shows no trend.[30] For India only one of the four project types – EE Industry – shows a declining trend for technology transfer, while Biomass energy, Fossil fuel switch and Wind show no trend.[31] The reduced rates of technology transfer for China and Brazil are due to declining rates of technology transfer over time as more projects of the most common project types are developed in those countries. The reasons for divergent trends for specific technologies in different countries – Landfill gas in Brazil and China and Wind in China and India – merits further investigation.

Technology transfer in the CDM, then, occurs beyond the individual projects as the number of projects of a given type in a host country increases.[32] That enables later projects of those project types / host countries to rely more on local knowledge and equipment. Since the overall rate of technology transfer claims has remained stable, the declining rates in such categories are being offset by high rates of technology transfer for CDM projects in smaller countries with fewer projects of a given type.

14 Capital Investment

Reported values of the anticipated investment are collected, converted to US dollars if necessary, and expressed as investment per $ktCO_2e$ reduced by project type. The investment per $ktCO_2e$ by project type is shown in Table 1. The estimated investment required varies widely by project type from \$10 per $ktCO_2e$ for PFCs to \$5,349 per $ktCO_2e$ for solar, and averages \$325 per $ktCO_2e$ across all project types.

The amount that is, or will be, invested in the 3296 CDM projects currently in the pipeline is estimated at almost US\$95 billion (Table 12). The amount invested by year during which the project entered the pipeline or was registered is shown in Figure 6. The estimated investment for projects in the pipeline has grown exponentially through 2007 with the number of projects in then pipeline. The growth appears to have levelled off; the number of projects and investment for the first 5 months of 2008 is about the same as for the corresponding period of 2007.

Figure 6
Estimated Investment by Year
(US$ million)

	For projects that entered the pipeline during the year	For projects registered during the year
2003	$133	$122
2004	$867	$436
2005	$9,854	$2,126
2006	$26,087	$1,854
2007	$45,920	
2008	$11,816[a]	
Note: a For the first 5 months of 2008		

The estimated investment in registered projects is less than $5 billion, reflecting the fact that only 30% of the projects in the pipeline have been registered and the registered projects have relatively low capital costs. The time lag between the start of a project and registration averages 351 days (Fenhann, 2008). This lag is reflected in the time profile of the estimated investment in registered projects.

China accounts for more than half of the total investment in CDM projects ($50.4 billion) and India accounts for 20% ($18.9 billion). About 40% of the total investment ($37.3 billion) represents capital invested in unilateral projects by host country project proponents. India is home to the most unilateral projects so its investment in unilateral projects ($16.6 billion) is 45% of the total unilateral investment. In India unilateral projects represent over 87% of the total investment.

Most of the CDM projects in the pipeline have not yet been implemented so the estimated investment is unlikely to have occurred. Even some of the registered projects may not yet have been implemented. However, the vast majority of projects that enter the CDM pipeline are ultimately registered and implemented.

The estimated investment for CDM projects may not be solely attributable to the CDM. For instance, wind farm and hydro projects are implemented to increase the host country's power generation capacity. In the absence of the CDM, it is likely that investment to increase the country's power generation capacity would have occurred, albeit with a different technology and lower capital outlay. But for project types where there is no revenue stream other than CDM credits, such as Landfill gas and CO_2 capture, it is fair to assume that the capital cost expenditures are solely attributable to the CDM.

15 Conclusions

Technology transfer is not an explicit objective of the Clean Development Mechanism, but the CDM can contribute to technology transfer by financing emission reduction projects using technologies currently not available in the host countries. This paper analyzes the technology transfer claims made by project participants in the Project Design Documents of 3296 projects in the CDM pipeline as of June 2008.

A definition of "technology transfer" is not provided to project participants, so each project is free to use its own interpretation of "technology transfer". However, from the claims it is clear that project participants overwhelmingly interpret technology transfer as meaning the use of equipment or knowledge not previously available in the host country for the CDM project.

The statements made by project participants in their PDDs indicate that in most cases technologies are being imported because they are lacking domestically. In some cases, a project may import new equipment or knowledge because it is more efficient, more reliable, or better in other respects than a similar technology already available domestically. It is difficult to know how common these cases are since the motivations for importing the technology are not always included in the PDD, but the impression is that the number is small.

Approximately 36% of the 3296 registered and proposed CDM projects claim some technology transfer. But these projects account for about 59% of the annual emission reductions, so technology transfer is more common for larger projects. Both the number of projects and the estimated annual emission reductions are crude proxies for the scale of technology transfer. The value of imported technology is not available from the PDDs. The value of the imported technology could range from a small fraction to almost the all of the cost of the project.

Technology transfer is very heterogeneous across project types. Technology transfer is claimed for a higher share of Agriculture, EE Own generation, Landfill gas, N_2O, HFC and Wind projects, and for a lower share of Biomass energy, Cement, Fugitive, Hydro, and Transportation projects. Technology transfer is more common for projects that involve foreign participants than for unilateral projects.

Most (53%) projects that claim technology transfer involve transfers of both equipment and knowledge. About 32% of the projects that claim technology transfer involve only imports of equipment. Transfers of knowledge alone involve 15% of the projects.

A host country can influence the extent of technology transfer involved in its CDM projects through the criteria it establishes for approval of CDM projects. Other factors, such as tariffs on imported equipment, also affect the extent of technology transfer involved in CDM projects. As a result, the rate of technology transfer is significantly higher than average for several host countries, including Bolivia, Ecuador, Guatemala, Honduras, Indonesia, Kenya, Malaysia, Mexico, Pakistan, South Africa, Sri Lanka, Thailand and Vietnam and significantly lower than average for Brazil, China, and India.

As more projects of a given type are implemented in a country the rate of technology transfer declines. Declining rates of technology transfer for the most common project types – EE Own generation, N_2O and Wind in China and Biomass energy and Landfill gas in Brazil – contribute to the low rates of technology transfer for those countries. Those results also indicate a transfer of technology beyond the individual CDM projects that allows later projects to rely more on local knowledge and equipment.

The technology transferred mostly (over 70%) originates from Japan, Germany, the USA, France, and Great Britain. Although technology transfer from Non-Annex I countries is less than 10% of all technology transfer, Brazil, China, India, South Korea and Chinese Taipei are the dominant sources of equipment (94%) and knowledge (70%) transfers from Non-Annex I sources.

The technology supply industry does not appear to restrict the distribution of the technology and/or keep the price high. For the project types with sufficient projects, project developers appear to have a choice among a number of domestic and/or foreign suppliers with no dominant supplier able to restrict the distribution of the technology and/or keep the price high.

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Annex A
Regression Analysis with Project Type and Host Country

Regression analysis can be used to examine relationships between technology transfer and combinations of project characteristics, host country characteristics and the host country. Essentially, this model should reveal whether technology transfer is more or less likely under different conditions.

Technology transfer, the dependent variable, takes a value of 1 when a project includes a technology transfer claim, regardless of the type of technology transfer claimed, and a value of 0 when technology transfer is not mentioned. With a dependent variable that has a value of either 0 or 1 the appropriate form of regression analysis is logit analysis. The results for three equations are presented in Table 5.

Equation 1 includes a constant, the project size (kt CO_2e reduced per year), whether it is a unilateral project, host country population, and host country GDP measured in millions of constant US dollars.

Results for Equation 1 indicate that the probability of technology transfer increases with project size and the GDP (positive coefficients) and declines for host countries with larger populations (negative coefficient). The results also show that the odds of a technology transfer claim are reduced for unilateral projects, which means it rises if the project includes foreign participants. The equation has a pseudo R^2 of 14% and correctly classifies 70% of the observations demonstrating a good fit to the model[33].

Equation 2 includes the same variables as equation 1 and adds variables for the different project types; for example, the Agriculture variable has a value of 1 for each agriculture project and 0 for any other project type. As part of the estimation procedure the statistical package drops any variable for which prediction is perfect. This will happen if there is only one project in a category or all projects in a category claim (or do not claim) technology transfer. For Equation 2 it dropped the CO_2 Capture and Tidal projects because all of the projects in these two types claimed technology transfer, and Energy distribution because none of those projects made any claim.

Regression analysis assumes that the independent variables are not related to one another; for example, that host country size is not related to its GDP, and other variables. Since this not true, the independent variables are linearly related (collinear). When the variables are linearly related, regression results may show that a variable is not related to technology transfer when it actually is. To analyze this possibility an equation that includes only project size, the unilateral variable and the project type variable was estimated for each of the remaining protect types. The project type variables that yield perfect predictions and those that have very little statistical significance were isolated. As a result, Equation 2 reveals that technology transfer is neither more or less likely to occur for Afforestation, Coal bed/mine methane, EE Households, EE service, EE supply side, Fossil fuel switch, Geothermal, HFCs, PFCs, Reforestation and Solar project types and were dropped in addition to the three project types (CO_2 Capture, Tidal and Energy distribution) that yield perfect predictions.

The insignificance of the HFC project type is a surprising result given that 89% of these projects claim technology transfer (Table 1). Insignificance suggests that technology transfer is neither more nor less likely for this project type than for all CDM projects (36%). Further testing revealed a strong interdependence between the project size and HFC project variables, rendering the tests for significance of the HFC variable unreliable. Once isolated, the HFC project type shows a strong positive relationship with technology transfers. In other words, due to limitations with regression analysis, the results were somewhat misleading for HFC projects due to their unusually large size (4,305 $ktCO_2$ per year). Once detected and corrected, the results demonstrated that technology transfer is more likely for HFC projects, confirming the results in Table 1.

Results for Equation 2 with the remaining 12 project type variables indicate that all but the Biogas, EE Industry, EE Own generation and Transport project types are all significant at the 0.05 level or higher.[34] Technology transfer is *more* likely for Agriculture, Landfill gas, N_2O and Wind projects. Although the variables are not included in Equation 2, as discussed above, technology transfer also is more likely for HFC projects.

Technology transfer is *less* likely for Biomass energy, Cement, Fugitive, and Hydro. All of these project types have low rates of technology transfer (Table 1). These results can be interpreted as a preference for local technology for these project types.

Foreign participation and GDP continue to increase the probability of technology transfer, while population continues to decrease it. Equation 2 has a pseudo R^2 of 31% and correctly classifies almost 77% of the observations demonstrating that the addition of the project type variables has improved the model.

Figure 1

Perfect predictions	Insignificant "z"
Bangladesh	Argentina
Cambodia	Armenia
Cuba	Chile
Dominican Republic	Colombia
Fiji	Egypt
Georgia	El Salvador
Guyana	Ivory Coast
Kyrgyzstan	Jamaica
Lao PDR	Morocco
Macedonia	Nepal
Malta	Nicaragua
Mauritius	Panama
Mongolia	Tanzania
Nigeria	Uruguay
Papua New Guinea	Azerbaijan
Qatar	Congo
Senegal	Jordan
Mozambique	Mali
Singapore	United Arab Emirates
Tajikistan	
Tunisia	
Uganda	

Equation 3 adds variables for the host countries. Host country population and GDP were dropped due to the collinearity between those variables and the host country variables. The initial estimation (not shown) dropped 22 of the country variables due to perfect prediction, mostly countries with only one project. To eliminate the effects of collinearity, the remaining countries were tested individually for significance and the countries in figure 1 were dropped from equation 3. For those countries, the logistic model turned up an insignificant "z" statistic which means that technology transfer is neither *more* or *less* likely to occur for the projects that are being hosted by those countries in figure 1. Equation 3 was then estimated with variables for the remaining 26 countries.

The coefficients for 15 of the countries in equation 3 are statistically significant, at the 0.05 level or higher. Technology transfer is *more* likely for projects in Bolivia, Ecuador, Guatemala, Honduras, Indonesia, Kenya, Malaysia, Mexico, Pakistan, South Africa, Sri Lanka Thailand and Vietnam. Technology transfer is *less* likely for projects in Brazil, China, and India. The results are consistent with the rate of technology transfer for the host countries in Table 4.

All the project types continue to show the same influence on the odds of a technology transfer except for EE own generation and Transport. Both of these project types have lost their significance with the addition of country variables suggesting that the latter have more explanatory power than those project types. The addition of the host country variables improves the overall model which now has a pseudo R^2 of 36% and correctly classifies 80% of the observations.

Table 1
Technology Transfer by Project Type

Project Type	Number of Projects	Average Investment ($USD/ktCO_2e$)	Average Project Size ($ktCO_2e/yr$)	Technology Transfer Claims as Percent of	
				Number of Projects	Annual Emission Reductions
Afforestation	4		86	25%	3%
Agriculture	172	12	38	92%	87%
Biogas	217	85	48	57%	58%
Biomass energy	524	256	56	22%	38%
Cement	35	96	149	9%	5%
CO2 capture	1		7	100%	100%
Coal bed/mine methane	51	36	452	37%	51%
EE Households	9	1525	32	56%	63%
EE Industry	142	278	39	27%	26%
EE own generation	292	202	166	34%	54%
EE service	6	1257	10	33%	36%
EE supply side	31	374	218	48%	81%
Energy distribution	4	1115	32	0%	0%
Fossil fuel switch	113	286	329	47%	80%
Fugitive	26	51	379	12%	3%
Geothermal	12	488	201	50%	53%
HFCs	19		4,305	89%	89%
Hydro	856	326	95	8%	12%
Landfill gas	265	58	162	67%	71%
N2O	59	17	788	95%	98%
PFCs	2	10	61	50%	66%
Reforestation	13	288	52	31%	29%
Solar	17	5349	23	41%	15%
Tidal	1		315	100%	100%
Transport	6	935	99	17%	7%
Wind	419	684	81	48%	55%
Grand Total	3296	325	144	36%	59%

Table 2
Technology Transfer Claims by Project Type for Unilateral and Small-Scale Projects

	Unilateral Projects		Small-Scale Projects	
Project Type	**Number of Projects**	**Annual Emission Reductions**	**Number of Projects**	**Annual Emission Reductions**
Afforestation	50%	44%	25%	3%
Agriculture	93%	87%	96%	95%
Biogas	32%	21%	56%	53%
Biomass energy	11%	16%	19%	33%
Cement	6%	4%		
CO2 capture	100%	100%	100%	100%
Coal bed/mine methane	100%	100%		
EE households	25%	44%	56%	63%
EE Industry	22%	26%	25%	25%
EE own generation	18%	26%	33%	40%
EE service	25%	22%	33%	36%
EE supply side	35%	73%	17%	28%
Energy distribution	0%	0%	0%	0%
Fossil fuel switch	40%	72%	27%	35%
Fugitive	12%	2%	33%	89%
Geothermal	67%	98%		
HFCs	100%	100%		
Hydro	16%	34%	7%	6%
Landfill gas	46%	48%	59%	49%
N2O	100%	100%		
PFCs	50%	66%		
Reforestation	14%	16%	31%	29%
Solar	42%	15%	38%	13%
Tidal	100%	100%		
Transport	0%	0%	33%	74%
Wind	41%	50%	31%	34%
Grand Total	30%	40%	30%	30%
	Number	**Reductions** (ktCO2e/yr)	**Number**	**Reductions** (ktCO2e/yr)
Total	1275	101,174	1485	41,784
Percentage of all projects	39%	21%	45%	9%
Note: The percentages in the upper panel are the unilateral or small-scale projects that claim technology transfer as a percentage of the unilateral or small-scale projects in the category.				

Table 3
Technology Transfer by Host Country Characteristics

	Number of Projects	Average Project Size ($ktCO_2e/yr$)	Technology Transfer Claims as Percent of Number of Projects	Technology Transfer Claims as Percent of Annual Emission Reductions
Country Size (Population)				
Population less than 1 million*	13	503	62%	60%
Population 1 million to 5 million	52	97	54%	55%
Population 5 million to 10 million	90	92	61%	66%
Population 10 million to 25 million	239	103	67%	72%
Population 25 million to 50 million	155	220	51%	74%
Population 50 million to 100 million	323	65	78%	79%
Population 100 million to 250 million	354	118	37%	55%
Population 250 million to 1 billion				
Population over 1 billion	2070	160	22%	55%
Total	3296	144	36%	59%
Country Groups				
(Based on per capita GDP)				
Least Developed Countries	23	229	65%	88%
Other Low-Income Countries	967	81	19%	42%
Lower Middle-Income Countries	1805	181	34%	59%
Upper Middle-Income Countries	452	125	73%	81%
Other	49	137	65%	40%
Grand Total	3296	144	36%	59%

Table 4
Technology Transfer for Projects in Selected Host Countries

Host Country	Number of Projects	Estimated Emission Reductions ($ktCO_2e/yr$)	Average Project Size ($ktCO_2e/yr$)	Technology Transfer Claims as Percent of	
				Number of Projects	Annual Emission Reductions
Brazil	274	26,986	98	28%	57%
China	1168	267,260	229	28%	59%
India	902	64,661	72	16%	41%
Malaysia	113	11,643	103	79%	88%
Mexico	180	11,157	62	91%	83%
South Korea	43	16,179	376	49%	82%
Other host countries	616	75,643	123	59%	61%
Total	3296	473,530	144	36%	59%

Table 5
Regression Results - Logit Model

	Equation 1	Equation 2	Equation 3		
Constant	0.2965414	0.5780353	0.2650	**Bhutan**	1.8273
	3.482	3.293	1.173		(1.273)
Project Size (kt C02e/year)	0.0017837	0.0017398	0.0016	**Bolivia**	0.8588
	7.906	6.769	6.273		0.846
Unilateral project	-0.3784727	-0.7110907	-0.2396	**Brazil**	-1.2839
	-4.231	-6.835	-1.968		-5.297
Population (millions)	-0.0020148	-0.0018857		**China**	-1.0708
	-15.449	-11.129			-5.325
GDP (millions US $)	7.28E-07	5.46E-07		**Costa Rica**	0.5301
	4.588	2.888			(0.536)
Agriculture		2.243406	2.4117	**Cyprus**	1.2511
		6.683	6.583		(1.106)
Biogas		0.1717662	-0.1395	**Ecuador**	2.5706
		(0.807)	(-0.565)		3.961
Biomass energy		-0.8637849	-0.6947	**Guatemala**	1.2161
		-4.665	-3.421		2.018
Cement		-1.913098	-2.0904	**Honduras**	1.3703
		-2.944	-3.025		2.616
EE industry		0.3365861	0.4201	**India**	-1.9636
		(1.318)	(1.565)		-9.506
EE own generation		0.3285734	0.1543	**Indonesia**	0.5545
		1.663	(0.756)		1.665
Fugitive		-3.027129	-3.2886	**Israel**	0.1035
		-3.575	-3.946		(0.239)
Hydro		-1.977629	-2.3722	**Kenya**	2.9644
		-10.12	-10.903		2.564
Landfill gas		0.494334	0.4853	**Malaysia**	1.0214
		2.453	2.293		3.459
N2O		2.976286	3.0504	**Mexico**	1.2988
		4.796	4.721		3.734
Transport		-1.855969	-1.5500	**Moldova**	0.9315
		-1.605	(-1.334)		(0.816)
Wind		1.092585	1.0318	**Pakistan**	1.6190
		5.951	5.413		1.715
				Paraguay	1.7337
					(1.246)
				Peru	0.1794
					(0.329)
				Philippines	-0.4671
					(-1.412)

			South Africa	0.3326
				0.596
			South Korea	-0.6045
				(-1.505)
			Sri Lanka	1.5939
				2.596
			Thailand	1.5520
				3.297
			Uzbekistan	-1.0919
				(-0.833)
			Vietnam	2.1063
				3.771
Number of observations	3281	3281		3290
Pearson's chi2	593.67	1322.95		1548.7
Probability > chi2	0	0		0
Pseudo R2	0.1388	0.3092		0.3608
Correctly classified	70.71%	77.02%		79.85%

Notes: Each cell shows the estimated coefficient for the variable above and the "asymptotic z" value below, which indicates its statistical significance. Variables NOT significant at the 0.05 level or greater are indicated by "parentheses".

The coefficients describe the effects of the independent variables on the predicted logarithmic odds of technology transfers. For example, in equation 3, each occurrence of a unilateral project decreases the log odds of a technology transfer by -0.2396. In other words, each occurrence of a unilateral project multiplies the odds of a technology transfer by $e^{-0.4494581} = 0.7869$, where e = 2.71828 is the base for natural logarithms. More simply, each occurrence of a unilateral project reduces the odds of a technology transfer by 21% (1 - 0. 7869).

The value of the Pearson χ^2 is used to test the null hypothesis that the coefficients of all of the variables are equal to zero. The probability of a χ^2 value greater than the value calculated for each of the equations is less than 0.0000. Thus the null hypothesis can be rejected with a very high degree of confidence, indicating that at least some of the variables are statistically significant. That is confirmed by the tests for the individual variables using the "z" values.

The pseudo R^2 and percent of observations correctly classified are indicators of the explanatory power of the equation. If the equation predicts a probability of technology transfer greater than 0.5 for a project given its characteristics, it is correctly classified if technology transfer was claimed and incorrectly classified if no technology transfer was claimed. Similarly, if the predicted probability is less than 0.5, it is correctly classified if no technology transfer was claimed and incorrectly classified if technology transfer was claimed.

Table 6
Technology Transfer Actions

	Percent of Projects	Percent of Annual Reductions
Transfer of Equipment Only	32%	38%
Transfer of Knowledge Only	15%	15%
Transfer of Equipment and Knowledge	53%	47%
Other	0.4%	0.2%
Total	100%	100%

Table 7
Technology Transfer by Project Type

Project Type	Projects	No technology Transfer	Equipment only	Knowledge only	Equipment and knowledge
Afforestation	4	75%	0%	25%	0%
	343	97%	0%	3%	0%
Agriculture	172	8%	8%	2%	83%
	6,570	13%	1%	0%	86%
Biogas	217	42%	9%	6%	41%
	10,489	41%	5%	9%	45%
Biomass energy	524	78%	8%	3%	10%
	29,585	62%	15%	7%	17%
Cement	35	91%	3%	3%	3%
	5,216	95%	2%	2%	1%
CO2 capture	1	0%	100%	0%	0%
	7	0%	100%	0%	0%
Coal bed/mine methane	51	63%	12%	4%	22%
	23,054	49%	19%	4%	28%
EE Households	9	44%	44%	0%	11%
	284	37%	47%	0%	16%
EE industry	142	73%	8%	5%	14%
	4,700	69%	7%	12%	12%
EE own generation	292	65%	20%	2%	13%
	8,345	45%	28%	1%	25%
EE Service	6	67%	17%	0%	17%
	58	64%	20%	0%	16%
EE supply side	31	52%	13%	6%	29%
	6,761	19%	4%	42%	34%
Energy distribution	4	100%	0%	0%	0%
	129	100%	0%	0%	0%
Fossil fuel switch	113	53%	22%	5%	19%
	37,212	20%	45%	4%	32%
Fugitive	26	88%	0%	4%	8%
	9,856	97%	0%	2%	1%
Geothermal	12	50%	17%	0%	33%
	2,411	47%	24%	0%	28%
HFCs	19	11%	37%	5%	47%
	81,792	11%	54%	2%	33%
Hydro	856	92%	4%	0%	3%
	81,349	88%	5%	1%	7%
Landfill gas	265	33%	17%	19%	31%
	42,865	29%	17%	15%	38%
N2O	59	5%	2%	25%	68%
	46,482	2%	2%	41%	54%
PFCs	2	50%	0%	50%	0%
	122	34%	0%	66%	0%

Project Type	Projects	No technology Transfer	Equipment only	Knowledge only	Equipment and knowledge
Reforestation	13	69%	0%	31%	0%
	679	71%	0%	29%	0%
Solar	17	59%	24%	0%	18%
	395	85%	12%	0%	3%
Tidal	1	0%	0%	0%	100%
	315	0%	0%	0%	100%
Transport	6	83%	17%	0%	0%
	592	93%	7%	0%	0%
Wind	419	51%	23%	9%	16%
	33,920	45%	26%	9%	20%
Grand Total	3296	64%	11%	5%	19%
	473,530	41%	22%	9%	28%

Note: the top row for each project type shows the distribution based on number of projects while the bottom row shows the distribution based on estimated annual emission reductions.

Table 8
Originating Countries of Equipment Only Technology Transfers by Project Type
(ktCO2/year)

	Agriculture	Biogas	Biomass energy	Cement	Coal bed/ mine methane	EE households	EE Industry	EE own generation	EE service	EE supply side	Fossil fuel switch	HFCs	Hydro	Landfill gas	N2O	Solar	Transport	Wind	Grand Total
Australia			298				26												323
Austria		15	85		1,746		26			59	36		31	615					2,613
Belgium			504								755								1,259
Brazil			179										247						426
China			211				13						51	41					317
Czech Republic													12					37	50
Denmark			1,476							30								1,331	2,838
Europe							608				96			1,202					1,907
France													236						236
Finland											6								6
Germany			610		1,746		340	611			1,789		182		960			1,790	8,027
Great Britain							39				10	3,393		1,755					5,198
India													33						33
Japan			690				2,792	540			3,059	19,893				12	39		27,025
Malaysia			163																163
Mexico		11																	11
Netherlands			31				12											9	52
Norway							13												13
Romania													26						26

	Agriculture	Biogas	Biomass energy	Cement	Coal bed/ mine methane	EE households	EE Industry	EE own generation	EE service	EE supply side	Fossil fuel switch	HFCs	Hydro	Landfill gas	N2O	Solar	Transport	Wind	Grand Total
Russia													478						478
South Africa																39			39
South Korea												4,248							4,248
Spain													20					1,955	1,975
Sweden			25										174						199
Switzerland							13												13
Taiwan	41											3,993							4,033
Thailand	24	34																	58
USA		11	286		2,283		426	2,802		177	1,680			1,407				192	9,263
Unknown		82	274	118		36	59	1,654	12		1,738	14,185	577	2,182		1		2,337	23,254
Grand Total	65	154	4,832	118	5,774	36	4,366	5,607	12	266	9,169	45,711	2,068	7,203	960	51	39	7,650	94,082

Table 9
Originating Countries of Knowledge Only Technology Transfers by Project Type
(ktCO2/year)

	Agriculture	Biogas	Biomass energy	Cement	Coal bed/mine methane	EE industry	EE own generation	Energy distribution	Fossil fuel switch	Fugitive	HFCs	Hydro	Landfill gas	N2O	PFCs	Reforestation	Wind	Grand Total
Belgium		61																61
Brazil																49		49
Canada	19																	19
Denmark			123														7	130
Europe			65															65
Finland									347									347
France													574					574
Germany			96			546								13,319			1,819	15,780
Great Britain													231	20.716				252
India			96															96
Italy		52											548					600
Japan						16			1,246									1,262
Netherlands		140								89			1,175					1,404
Russia						136												136
Spain													132					132
Switzerland			864	66						220								1,150
Unknown		280	176		921			194			1,434	24	1,418		80			4,527
USA							337							4,081				4,417
Grand Total	19	533	1,419	66	921	698	337	194	1,593	310	1,434	24	4,078	17,420	80	49	1,826	31,002

Table 10

Originating Countries of Equipment and Knowledge Technology Transfers by Project Type

($ktCO_2$/year)

	Agriculture	Biogas	Biomass energy	Coal bed/ mine methane	EE households	EE Industry	EE own generation	EE supply side	Fossil fuel switch	Fugitive	Geothermal	HFCs	Hydro	Landfill gas	N2O	Solar	Tidal	Wind	Grand Total
Argentina													67						67
													51						51
Australia		22	129								93			104					348
		22	193								93		10	104					422
Austria		61		376		353								110			311		1,211
		39		376		353								110			311		1,189
Belgium			572								281								853
			572																572
Brazil		81	236																317
		62	297																359
Canada	2,190	51	49											2,542					4,833
	2,739	62	74					342					10	4,796					8,023
China													230						230
													88						88
Costa Rica																			
													0.267						0.3
Denmark	67		2,535			87								108				1,392	4,190
	613	43	2,535			87								108	1,158			1,324	5,869
El Salvador																			
											140								140
Europe			92						1,513					94					1,699
			92	912					455				56						1,515

	Agriculture	Biogas	Biomass energy	Coal bed/ mine methane	EE households	EE Industry	EE own generation	EE supply side	Fossil fuel switch	Fugitive	Geothermal	HFCs	Hydro	Landfill gas	N2O	Solar	Tidal	Wind	Grand Total
Finland			122			9													130
			122			17							0						139
France			129						283			13,980	276						14,668
			193			12			283			13,980	276		4,302				19,046
Germany		756	298	167	45	169	185	36	903			3,834	27	394	9,113	4		417	16,350
		772	120	167	45	24	185	36	3,173			3,834	36	234	6,765	4		477	15,873
Great Britain		805	37	167				532				2,802		406	2,466				7,216
		874		293				361				2,802		781	1,887				7,000
Iceland											37								37
											37								37
India			161										34						195
			98										34						132
Italy						33								1,470					1,503
						33								38	2,288				2,359
Japan		38	272			2,937	5,715	304	8			5,410	50	73	2,317				17,125
		38	334			2,937	5,715	304	8			5,410	55	73	2,317				17,193
Luxembourg															3,050				3,050
															2,288				2,288
Malaysia		27	44											70					141
			44											70					114
Mexico		19																	19
		38																	38
Netherlands	364	197	30											2,819				53	3,462
		170	30											2,819				53	3,071
New Zealand											93			76					169
		1,251									233			76					1,559

	Agriculture	Biogas	Biomass energy	Coal bed/ mine methane	EE households	EE Industry	EE own generation	EE supply side	Fossil fuel switch	Fugitive	Geothermal	HFCs	Hydro	Landfill gas	N2O	Solar	Tidal	Wind	Grand Total
Norway													351						351
													351						351
Poland													67						67
													51						51
Singapore		22																	22
		22																	22
Slovenia													67						67
													51						51
South Korea									1,058					163					1,221
														163					163
Spain		48						171					41					1,950	2,210
													41	126				1,939	2,106
Sweden	1,826	21		231										77					2,155
				231									51						282
Switzerland						27								231					258
						27								767					794
Taiwan																			
													0.267						0.3
USA	2,190	130	238			325	216		2,244		93		1	2,393	6,071			39	13,940
	3,284	181	238			450	216		283		93		57	605	2,014			39	7,460
Unknown		1,784	473	4,981		2,128	209	167	1,309	111	182		266	1,489	1,150			1,901	16,150
		488	473	3,943		2,128	209	167	3,115	111	182		262	1,751	1,150			1,920	15,898
Grand Total	6,636	4,063	5,417	5,922	45	6,068	6,325	1,211	7,319	111	779	26,026	1,478	12,620	24,168	4	311	5,752	114,254
	6,636	4,063	5,417	5,922	45	6,068	6,325	1,211	7,319	111	779	26,026	1,478	12,620	24,168	4	311	5,752	114,254

Note: the top row for each country shows the expected annual emission reductions based on the technology transfer of equipment, while the bottom shows the expected annual emission reductions based on the technology transfer of knowledge

Table 11
Diversity of Technology Supply by Project Type

Project Type	Number of Projects	Projects with No Technology Transfer	Number of Projects that Claim Technology Transfer	Number of Known Technology Suppliers	Share of Largest Supplier*	Share of Four Largest Suppliers*
Afforestation	4	3	1			
Agriculture	172	13	159	6	41%	96%
Biogas	217	94	123	24	26%	67%
Biomass energy	524	411	113	19	39%	66%
Cement	35	32	3	2	65%	
CO2 capture	1	-	1			
Coal bed/mine methane	51	32	19	6	35%	90%
EE Households	9	4	5	1	100%	
EE Industry	142	103	39	16	30%	63%
EE own generation	292	192	100	6	56%	98%
EE service	6	4	2	1	100%	
EE supply side	31	16	15	11	39%	79%
Energy distribution	4	4	-			
Fossil fuel switch	113	60	53	14	39%	91%
Fugitive	26	23	3	1	100%	
Geothermal	12	6	6	8	37%	82%
HFCs	19	2	17	6	44%	86%
Hydro	856	789	67	21	17%	59%
Landfill gas	265	87	178	21	24%	59%
N2O	59	3	56	9	51%	85%
PFCs	2	1	1			
Reforestation	13	9	4	3	77%	
Solar	17	10	7	3	77%	
Tidal	1	-	1			
Transport	6	5	1	1	100%	
Wind	419	216	203	6	38%	99%
Grand Total	3296	2,119	1,177			

* Share of technology supplier countries is expressed as a % of annual emission reductions

Table 12
CDM Project Revenue and Investment by Country
for Projects that Entered the Pipeline until June 2008

Host country	Number of projects that entered the CDM pipeline until June 2008	Projected annual emission reductions of those projects (kCERs)	Estimated Annual Revenue ($ million)		Estimated capital invested in projects that entered the pipeline until June 2008	Estimated capital invested in unilateral projects that entered the pipeline until June 2008
			$10.70/CER (primary market)	$17.75/CER (secondary market)		
			Million USD			
Argentina	24	4,795	51.31	85.11	596	488
Armenia	7	345	3.69	6.12	42	1
Azerbaijan	3	785	8.40	13.93	506	494
Bangladesh	4	235	2.52	4.17	97	70
Bhutan	3	3,810	40.76	67.62	1,242	1,242
Bolivia	6	642	6.87	11.40	218	213
Brazil	274	26,986	288.75	479.00	5,226	3,133
Cambodia	3	125	1.34	2.22	16	6
Chile	52	6,833	73.11	121.29	933	568
China	1168	267,260	2,859.68	4,743.86	50,382	8,258
Colombia	26	4,099	43.86	72.76	924	188
Congo	2	579	6.19	10.28	15	8
Costa Rica	6	294	3.14	5.21	68	8
Cuba	4	693	7.42	12.30	145	-
Cyprus	6	146	1.56	2.59	58	53
Dominican Republic	3	466	4.98	8.26	244	165
Ecuador	19	930	9.95	16.51	252	122
Egypt	8	2,527	27.04	44.86	443	25
El Salvador	8	634	6.78	11.26	323	212
Fiji	1	25	0.27	0.44	26	-
Georgia	4	323	3.45	5.72	57	-
Guatemala	16	1,217	13.03	21.61	541	265
Guyana	1	45	0.48	0.79	32	-
Honduras	21	553	5.92	9.82	176	88
India	902	64,661	691.88	1,147.74	18,897	16,596
Indonesia	65	7,642	81.77	135.64	1,168	167
Israel	32	3,184	34.07	56.52	482	381
Ivory coast	2	1,027	10.99	18.23	62	7
Jamaica	2	284	3.04	5.04	58	22
Jordan	3	582	6.23	10.33	206	-
Kenya	7	654	7.00	11.61	349	-
Kyrgyzstan	1	73	0.78	1.30	1	-
Lao PDR	1	3	0.04	0.06	2	-
Macedonia	1	200	2.14	3.56	41	-

Host country	Number of projects that entered the CDM pipeline until June 2008	Projected annual emission reductions of those projects (kCERs)	Estimated Annual Revenue ($ million)		Estimated capital invested in projects that entered the pipeline until June 2008	Estimated capital invested in unilateral projects that entered the pipeline until June 2008
			$10.70/CER (primary market)	$17.75/CER (secondary market)		
			Million USD			
Malaysia	113	11,643	124.58	206.66	924	159
Mali	2	168	1.80	2.99	101	-
Malta	1	20	0.21	0.36	1	-
Mauritius	1	298	3.18	5.28	130	-
Mexico	180	11,157	119.38	198.04	2,642	835
Moldova	5	357	3.82	6.33	115	8
Mongolia	4	251	2.69	4.46	252	187
Morocco	8	408	4.37	7.25	376	343
Mozambique	1	46	0.49	0.81	1	1
Nepal	3	127	1.36	2.26	17	-
Nicaragua	4	500	5.35	8.88	188	21
Nigeria	2	4,029	43.11	71.51	227	150
Pakistan	9	2,919	31.24	51.82	332	162
Panama	8	650	6.95	11.53	287	126
Papua New Guinea	1	279	2.98	4.95	136	136
Paraguay	3	74	0.79	1.31	23	21
Peru	23	3,279	35.09	58.21	1,122	259
Philippines	71	2,782	29.77	49.38	703	197
Qatar	1	2,500	26.75	44.37	127	127
Senegal	1	131	1.41	2.33	8	-
Singapore	4	534	5.72	9.48	147	138
South Africa	22	4,215	45.10	74.81	412	344
South Korea	43	16,179	173.12	287.19	1,199	927
Sri Lanka	14	419	4.48	7.44	159	47
Tajikistan	1	51	0.54	0.90	27	27
Tanzania	2	520	5.57	9.23	8	6
Thailand	44	2,922	31.26	51.86	518	71
Tunisia	2	688	7.36	12.20	11	-
Uganda	3	96	1.03	1.70	25	11
United Arab Emirates	5	335	3.59	5.95	27	24
Uruguay	3	251	2.69	4.46	25	12
Uzbekistan	7	1,287	13.77	22.84	24	-
Vietnam	20	1,756	18.79	31.17	350	112
Grand Total	3296	473,530	5,066.77	8,405.15	94,679	37,229

Table 13
Regression Results – Trends

	Equation 3	Equation 4		Equation 3	Equation 4
Constant	0.2650	0.0631	**Bhutan**	1.8273	1.3968
	1.173	0.2830		(1.273)	(0.975)
Project Size (kt C02e/year)	0.0016	0.0015	**Bolivia**	0.8588	0.6793
	6.273	5.9850		0.846	-0.7190
Unilateral project	-0.2396	-0.1760	**Brazil**	-1.2839	-1.1767
	-1.968	(-1.461)		-5.297	-4.9210
Trend		-0.0059	**China**	-1.0708	-0.5786
		-5.9930		-5.325	-2.7760
Agriculture	2.4117	2.6271	**Costa Rica**	0.5301	0.3571
	6.583	7.1790		(0.536)	(0.375)
Biogas	-0.1395	-0.0173	**Cyprus**	1.2511	1.2907
	(-0.565)	(-0.071)		(1.106)	(1.137)
Biomass energy	-0.6947	-0.4142	**Ecuador**	2.5706	2.2283
	-3.421	-2.0110		3.961	3.5010
Cement	-2.0904	-2.0998	**Guatemala**	1.2161	0.9663
	-3.025	-3.0940		2.018	1.6840
EE industry	0.4201	0.5156	**Honduras**	1.3703	1.1701
	(1.565)	1.9230		2.616	2.3230
EE own generation	0.1543	0.3671	**India**	-1.9636	-1.6072
	(0.756)	1.7830		-9.506	-7.7110
Fugitive	-3.2886	-3.0215	**Indonesia**	0.5545	0.6051
	-3.946	-3.7630		1.665	1.8610
Hydro	-2.3722	-1.7361	**Israel**	0.1035	0.1936
	-10.903	-7.5990		(0.239)	(0.449)
Landfill gas	0.4853	0.5934	**Kenya**	2.9644	2.6750
	2.293	2.8380		2.564	2.3590
N2O	3.0504	2.9983	**Malaysia**	1.0214	1.1596
	4.721	4.6270		3.459	3.9760
Transport	-1.5500	-1.3897	**Mexico**	1.2988	1.4249
	(-1.334)	(-1.209)		3.734	4.1750
Wind	1.0318	1.3191	**Moldova**	0.9315	1.1307
	5.413	6.7100		(0.816)	(0.989)
			Pakistan	1.6190	1.5133
				1.715	1.6900
			Paraguay	1.7337	1.5215
				(1.246)	(1.15)
			Peru	0.1794	0.0587
				(0.329)	(-0.114)
			Philippines	-0.4671	-0.3604
				(-1.412)	(-1.099)
			South Africa	0.3326	0.3994
				0.596	(0.729)
			South Korea	-0.6045	-0.5813
				(-1.505)	(-1.464)

	Equation 3	Equation 4		Equation 3	Equation 4
			Sri Lanka	1.5939	1.2719
				2.596	2.1330
			Thailand	1.5520	1.6334
Number of observations	3290	3290		3.297	3.4810
Pearson's chi2	1548.7	1593.5	**Uzbekistan**	-1.0919	-0.8677
Probability > chi2	0	0		(-0.833)	(-0.673)
Pseudo R2	36%	37%	**Vietnam**	2.1063	1.7856
Correctly classified	79.85%	80.79%		3.771	3.2720

Table 14
Trend in Technology Transfer for the Three Largest Host Countries

	BRAZIL						CHINA						INDIA					
	% of Projects with TT			% of ER with TT			% of Projects with TT			% of ER with TT			% of Projects with TT			% of ER with TT		
	Projects 1-854	Projects 855-2293	Projects 2294-3296	Projects 1-854	Projects 855-2293	Projects 2294-3296	Projects 1-854	Projects 855-2293	Projects 2294-329	Projects 1-854	Projects 855-2293	Projects 2294-3296	Projects 1-854	Projects 855-2293	Projects 2294-329	Projects 1-854	Projects 855-2293	Projects 2294-3296
Afforestation																		
Agriculture	85%	100%		89%	100%								0%			0%		
Biogas								75%	44%		56%	58%	11%		38%	5%		37%
Biomass energy	9%	21%	5%	21%	12%	4%	50%	61%	31%	49%	71%	37%	5%	6%	9%	6%	14%	11%
Cement									17%			7%						
Coal bed/mine methane								35%	33%		55%	27%						
EE Households															50%			50%
EE industry								33%	50%		2%	23%	28%	27%	24%	61%	34%	17%
EE own generation							17%	50%	34%	74%	70%	53%	3%	15%	9%	1%	15%	37%
EE Service															33%			27%
EE supply side		100%			100%			100%	100%		100%	100%	20%		67%	32%		99%
Energy distribution																		
Fossil fuel switch			33%			62%	50%	83%	83%	91%	84%	88%	7%	62%	60%	0%	86%	85%
Fugitive	100%			100%										100%			100%	
HFCs							86%	100%		81%	100%		75%		100%	95%		100%
Hydro	4%	5%	33%	4%	6%	17%	4%	1%	1%	4%	4%	1%	5%		6%	2%		1%
Landfill gas	69%	45%	33%	82%	45%	29%	71%	87%	67%	59%	91%	79%		33%	11%		60%	8%
N2O	100%	100%	100%	100%	100%	100%		100%	57%		100%	43%						
PFCs		100%			100%													
Reforestation													100%	50%		100%	93%	
Solar																		
Transport														100%			100%	
Wind	20%	100%		79%	100%		83%	70%	34%	81%	71%	35%	16%	52%	24%	16%	69%	27%
Grand Total	**31%**	**27%**	**18%**	**73%**	**32%**	**18%**	**55%**	**34%**	**16%**	**77%**	**66%**	**30%**	**10%**	**21%**	**21%**	**43%**	**37%**	**43%**

Notes

[1] United Nations, 1992, Article 4.1.

[2] United Nations, 1997, Article 10(c).

[3] See FCCC, 2006a.

[4] IPCC, 2000, p. 3.

[5] IPCC, 2000, p. 3.

[6] FCCC, 2006b, p. 16.

[7] FCCC, 2006b, pp. 5-12.

[8] The definition of a small-scale project has changed over time. For the analyses a project is classified as a small-scale project based on the methodology used to calculate the emission reductions. The means the definition of small-scale applicable when the PDD was prepared is used for the project.

[9] An arbitrary date must be chosen because the number of projects in the pipeline increases by about 3 per day.

[10] There are no "afforestation" or "other" projects so only 24 project types are used in the analysis. This is the most extensive list of project types. Ellis and Karousakis, 2006 reports 14 project types – renewable electricity, electricity generation, energy efficiency, (avoided) fuel switch, F-gas reduction, N_2O reduction, landfill gas capture, other CH_4 reduction, manure and wastewater, transport, cement, sinks, carbon capture and storage, and other. The UNFCCC reports registered projects by 8 project types – agriculture, chemical industries, energy demand, energy industries (renewable / non-renewable sources), fugitive emissions from fuels (solid, oil and gas), fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride, manufacturing industries, and waste handling and disposal. See <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html>

[11] A few projects use both a small-scale methodology and a methodology for a regular project. Those projects are classified as regular projects.

[12] Keywords included: technology, transfer, import, foreign, abroad, overseas, domestic, indigenous, etc.

[13] The population and GDP data are from the "Data-Population2000" and "Data-GDP-PPP" sheets respectively.

[14] When total emission reductions to 31 December 2012 are used as the measure of project size the results are similar. It also yields similar results for unilateral and small-scale projects. Since total reductions to 31 December 2012 combines the effect of annual emission reductions and the project start date, annual emission reductions is judged to be a better measure of project size and only those results are reported.

[15] All but two – Energy distribution and Transport – of the 26 project types have unilateral projects in

the pipeline.

[16] All but four project types – CO_2 capture, Coal bed/mine methane, HFCs and Tidal – of the 26 project types have projects in the pipeline with foreign participants.

[17] Eight of the 26 project types – Cement, Coal bed/mine methane, Energy distribution, Geothermal, HFCs, N_2O, PFCs and Tidal – have no small-scale projects. All of the CO_2 capture projects in the pipeline are small-scale projects.

[18] Brazil, 2005, p. 2.

[19] China, 2005, Article 10, p. 2.

[20] India, undated, p. 1.

[21] Lee, 2006, slide 7.

[22] Regression analysis assumes that the independent variables are not related to one another; for example, that a project type is not related to project size and other variables. When the variables are linearly related (collinear), regression results may show that a variable is not related to technology transfer when it actually is. To analyze this possibility an equation that includes only project size, the unilateral variable and the project type variables was estimated for each host country. Project types and host countries that had very low statistical significance – were neither more nor less likely to involve technology transfer – were dropped from the analysis.

[23] The credit purchase data are distorted by London's role as the main financial centre for credit trading. Credit purchases by funds and other financial intermediaries located in London are shown as UK credit purchases.

[24] Barton, 2007 found that developing countries have good access to solar photovoltaic and wind technologies at competitive prices. This is consistent with the data in Table 11 for Wind. The number of Solar projects is too small to support or reject Barton's conclusion.

[25] This may be due in part to reclassification of projects from EE Industry.

[26] The variable has an effect on some of the coefficients for some of the other variables. The coefficient for the "Unilateral" project type is no longer significant, which may be due to multi-collinearity. The coefficients for EE Industry and EE Own Generation are now significant in equation 4, while the coefficient for South Africa has been rendered insignificant.

[27] For example, the value of the variable for the tenth wind project in China is 10. The order of the projects is based on the date when the project entered the pipeline.

[28] Dechezleprêtre, et al., found this variable to be statistically significant with a negative coefficient.

[29] These 5 project types account for 80% of all projects in the pipeline for China.

[30] These 3 project types account for 65% of all projects in the pipeline for Brazil.

[31] These 4 project types account for 80% of all projects in the pipeline for India.

[32] This supports the assessment that the CDM contributes to technology transfer by lowering several technology-transfer barriers and by raising the transfer quality (Schneider, et al., 2008).

[33] Diagnostic tests on the influence of individual observations while comparing both the Pearson $\chi 2$ and the deviance to the predicted probabilities indicated that there was one outlier observation exerting undue influence on the model. This observation was discarded.

[34] Dropping the additional project type variables has virtually no impact on the explanatory power of the equation because the pseudo R^2 and percentage of observations classified are virtually unaffected.