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Current Status of Transport Projects in the Clean Development Mechanism

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While the project portfolio of the Clean Development Mechanism (CDM) is expanding rapidly, the transport sector has so far played a rather minor role. Up to now only two transport projects are at the validation stage. The underlying reason is that so far only two methodologies for baseline establishment and monitoring have been approved, which is a prerequisite for submitting projects for registration. Eleven other transport projects have submitted proposals for new methodologies to the EB. However, none of these have so far been approved. In some cases, methodologies have been going through revisions for several years now. This paper therefore analyses the methodology proposals to determine whether the low rate of approval has been due to flawed methodology proposals or due to fundamental problems connected to the nature of transport projects. We conclude that the main reason why there are so far only very few transport projects at the validation stage is their high complexity. The analysis further shows that the development of transport methodologies is especially complicated if the project is located in the public sector. Nevertheless, it seems possible to remove most of the barriers currently preventing methodologies from being successfully approved. Therefore the small number of transport methodologies currently under consideration does not point to an insurmountable problem. Rather, due to the high complexity of transport projects methodology development needs a lot of time, but once the first methodologies in the transport sector have clarified most of the uncertainties more projects and also new methodologies will probably follow.

1 Introduction

The transport sector accounts for about a quarter of global carbon dioxide (CO2) emissions (IEA 2005). Global transport-related greenhouse gas (GHG) emissions are currently rising by 2.5 percent per year, in the countries of the global South even by 4.4 percent (IEA 2004). The transport sector is thus the fastest growing source of GHG emissions. It is expected that the urban population in countries of the South will double by 2030, which may lead to a corresponding further increase of urban transport emissions (Browne et al. 2005: 2).

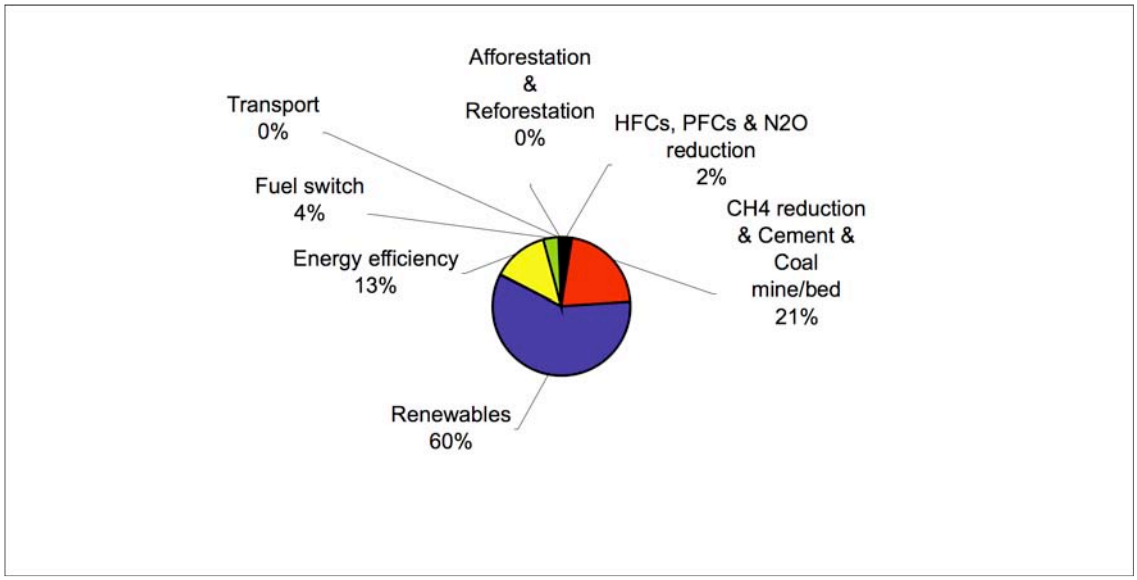
Hence, developing sustainable transport patterns in countries of the global South is one of the most urgent challenges in tackling climate change. The Kyoto Protocol to the United Nations Framework Convention on

Climate Change (UNFCCC) provides with its Clean Development Mechanism (CDM) a way to encourage industrialised countries to foster climate-friendly projects in developing countries. The objective of the project-based mechanism is two-fold:

- to assist countries not included in Annex I to the UNFCCC ("developing countries") in achieving sustainable development, and
- to allow countries that are included in Annex I to the UNFCCC and have inscribed specified greenhouse gas (GHG) emission targets in Annex B to the Kyoto Protocol ("industrialised countries") to acquire Certified Emission Reductions (CERs) from CDM project activities undertaken in Non-Annex I Parties and count them towards their Kyoto targets.

Although the CDM has proven to be a popular tool (to date more than 1,700 projects have been registered or are at the validation stage, expecting a cumulative 1.9 billion CERs by 2012), there are currently only 2 transport projects in the pipeline.[1]

Figure 1: Number (%) of CDM Projects in Each Sector



Source: Fenhann 2007

One underlying reason is that so far only two methodologies for calculating a project's emission reduction have been approved for transport projects, which is a prerequisite for submitting projects for registration. Eleven other transport projects have submitted proposals for new methodologies to the EB. However, none of these have so far been approved. In some cases, methodologies have been going through revisions for several years now.

[1] Fenhann, Joergen (2007): CDM pipeline overview. Updated 14 March 2007. UNEP Risoe Centre. http://www.cd4cdm.org/Publications/CDMpipeline.pdf [accessed 14 March 2007]

This paper aims at analysing the reasons for the low rate of methodology approval in the transport sector. The question is whether the rejections were due to flawed methodology proposals or due to fundamental problems related to the nature of transport projects. The paper therefore surveys all methodologies that have so far been proposed to the CDM Executive Board and examines the reasons why they were rejected.

The paper first outlines the elaborate project cycle projects have to undergo to get registered as CDM projects. Subsequently, the current portfolio of CDM transport projects is analysed. The projects are grouped into three categories and for each category the difficulties which projects have faced regarding approval are highlighted. The results are then synthesised in order to determine the underlying reasons for the low rate of methodology approval in the transport sector.

There are several possible ways to analyse the CDM project portfolio. One is to consider the projects which are currently under validation or have already been registered. Another possibility is to also consider those projects whose methodologies are awaiting approval. Finally, one could also include projects which are currently being developed. However, there is no public database on the projects which are currently under development. Therefore projects under development will not be taken into consideration. Rather the following concentrates on projects which have already been approved or are presently under validation (project pipeline) and on projects whose methodologies are awaiting approval (methodology pipeline).[2] Apart from the projects with approved methodologies, eleven other transport projects have submitted proposals for new methodologies to the EB. While the methodologies of five projects were rejected, the proposals of the other six projects are still under consideration, but these are either a second version or have considerable obstacles regarding approval.

2 Difficulties of Transport Projects Regarding CDM Approval

The methodologies which have already been approved and those awaiting approval can be divided into three different categories. The first category consists of methodologies of projects for switching from conventional to less emission-intensive fuels or biofuels, the second concerns efficiency improvements within one transport mode[3], and the third modal shifts. The projects and their respective methodologies are listed in Table 1. Annex 1 provides a more detailed overview of the different projects sorted by category. Some of the projects have submitted a second methodology to the EB because the first one was rejected and required complete revision. Therefore there are more methodologies than projects.

[2] Projects not using already approved methodologies and without own approved methodologies are not listed in the project pipeline, but in a separate methodology pipeline.
[2] Methodologies NM0158, NM0052 and NM0105 also contain modal shift elements.

Table 1: Proposed CDM Transport Methodologies

Fuel Switch	Efficiency Improvements	Modal Shift
Switching fossil fuels from petro-diesel to biodiesel in transport sector (NM0069. NM0108)	Emission reductions by low-greenhouse gas emitting vehicles (AMS-III.C.) (Small Scale)	Change from road to sea transport NM0128
Transportation bio-fuel production with life-cycle-assessment (LCA) (NM0109, NM0129)	Transmilenio – urban mass transportation system (NM0052, NM0105), *Including modal shift elements*	Change from road to pipeline transport (SSC58) (Small Scale)
Khon Kaen fuel ethanol project (NM0082, NM0185)	BRT project. Mexico (NM0158), *Including modal shift elements*	Cosipar Transport Modal Shift Project (NM0201)
Palm methyl ester biodiesel fuel production for transport using LCA (NM0142)	Behaviour-oriented demand-side EE program (Small Scale) (SSC41)	
LPG retail outlets for cars (NM0083)		
Biolux Benji Biodiesel Beijing Project (NM0180)		

In the following, the main characteristics of the methodologies are outlined for each of the three categories. Afterwards, the project-specific as well as the more general methodological difficulties identified by the EB are highlighted.

2.1 Fuel Switch

The idea of fuel-switch projects is to substitute conventional diesel or petrol with less emission-intensive fuel, which is usually a biofuel.[4] The aim of the projects is to cultivate energy plants and use them for the production of biofuel. In methodologies NM0069/NM0108 it is also envisaged to use fatty acids, animal fats and other fats as raw material for the production process. In methodology NM0180 the production would be completely based on waste cooking oil. The produced biofuel is sold to suppliers who usually blend it with conventional fuels.

Because in developing countries nowadays almost no biofuel is being produced or consumed, it is assumed that the biofuel from the projects would be completely used to substitute conventional petrol/diesel and hence utilisation of an equivalent amount of petrol/diesel would be avoided.[5] A second basic assumption relates to the "carbon neutrality" of biofuels. The CO_2 which is emitted during the process of combustion had previously been sequestered from the air during plant growth. Therefore net emissions are zero. The envis-

[4] In this context methodology NM0083 will not be discussed. This methodology planned to use LPG as alternative fuel, with the purpose to establish LPG retail outlets for 4-, 3- and 2-wheelers. However, since the methodology contained a huge amount of avoidable flaws and inaccuracies, specific characteristics and difficulties of the methodology will not be considered.

[5] Within the scope of the final recommendation on NM0082 the Meth Panel stated that this assumption is correct until pre-project production capacity within the national market for the specific biofuel is less than 75% of the maximum potential demand level. See EB decision at: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenNM=NM0082&single=1 [accessed 3 March 2007].

aged use of non-vegetable fats is also considered as carbon neutral by the methodologies, but reasons for this assumption are not indicated. Based on these assumptions, project developers calculate the GHG emission reduction to be achieved through the project activity (production and use of biofuel) taking into consideration emissions resulting from the cultivation of the energy plants, the production process of the biofuel, and the transportation of feedstock, etc.

Difficulties

All fuel switch methodologies in general face the problem that projects at all stages cause GHG emissions which are not directly linked to the project activity, i.e. so-called **leakages**. Methodologies not only have to detect the various sources of direct and indirect emissions but also must quantify them. One great difficulty concerning all of the proposed biofuel methodologies lies in the correct assessment of a possible change in "carbon pools", i.e. CO2 stored in the form of biomass (in a specific area). To avoid an overestimation of emission reductions, the net decrease in carbon pools due to the project activity - be it directly or indirectly - and also the potential increase in carbon pools in the absence of the project activity have to be taken into account, assessed and if necessary calculated. As a possible solution methodology NM0109 proposed that project developers have to hold a letter of the land owner or producer of the biomass confirming that the project activity "will not constrain the afforestation/reforestation activities" or that "there are no other plans to utilize the area for other exclusive GHG emission reduction activities". However, the EB decided that such a letter is not sufficient since the risk of a conflict of interest would be too high. Instead, an alternative land-use scenario including an adequate assessment of a net decrease of carbon pools should be developed for the land that is to be used.[6]

In addition, various other leakages were also not treated adequately by some of the methodologies. In particular the EB pointed out the following difficulties:

- Methodologies NM0108, NM0109 and NM0129 considered N_2O emissions due to the application of fertilizers inadequately or not at all. This is problematic because the GHG -potential of N_2O is 310 times higher than the GHG potential of CO_2.
- Within the production process of biofuels (e.g. esterification) chemical compounds like methanol are used. The carbon within these compounds mostly derives from fossil sources. Therefore some part of the carbon in the biofuel is not "carbon neutral". The amount of fossil-based carbon in the biofuel has to be calculated. Methodologies NM0069, NM0108 and NM0190 did not take the fossil-based carbon into account.
- Furthermore, the possibility of exporting the biofuel to Annex I countries should not be discarded without justification (NM0069, NM0082, NM0109, NM0129 and NM0185). A signed confirmation by the seller that they will not export the biofuel to Annex I countries as proposed by methodology NM0129 is not sufficient.[7] Exported biofuel will be accounted as GHG emission reductions in Annex I countries. If CERs

[6] See http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=10&OpenNM=NM0109&cases=C#NM0109 [accessed 3 March 2007].

[7] See Final Recommendation: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenNM=NM0129&single=1 [accessed 3 March 2007].

were issued to this biofuel, one emission reduction would effictively be counted twice. A project should therefore not generate CER, if it is exporting the biofuel to Annex I countries.[8]

- A potential change in fuel efficiency due to the combustion of biofuel in engines and resulting potentially higher CO_2 emissions were not accounted for by methodologies NM0069 and NM0109 and not fully accounted for by methodologies NM0082 and NM0142.
- Finally, it has to be ensured that all biofuel sold is actually used for the intended purpose. A possible loss, spill or destruction after the point of sale was not addressed suitably by three of the methodologies (NM0069, NM0109 and NM0185).

Some innovative methodologies proposed using **Life Cycle Assessment (LCA)** to determine net emission reductions. They provided LCA emission factors for both the conventional fuel to be substituted and for the biofuel and would therefore be able to assess GHG emission of each fuel from cradle to grave. Although in general judged to be an appropriate approach by the Methodology Panel, the methodologies used emission factors that were not applicable to the respective project activity (NM0082, NM0142).

Currently another considerable problem seems to be the **avoidance of double counting**. Methodologies claiming CERs from the production of biofuels have to ensure that a potential project activity at the demand side does not also claim CERs for the use of the same biofuels. To facilitate clarification the EB opened a call for public input on this issue starting 2 October and ending on 20 October 2006.[9] The EB further noted in its final recommendation on methodology NM0185 that a "guidance tool" will be developed and approved.[10]

In addition to these general difficulties, the EB also detected a lot of **methodology-specific flaws**. Some methodologies contained deficiencies which others avoided while some deficiencies related to the specific design of the respective methodology. Examples for errors which only occurred in one methodology are:

- The application of the additionality tool[11] was mixed up with considerations regarding the applicability of the methodology. This produced confusion and ultimately did not prove the additionality of the project (NM0109/NM129)
- Lack of a "sensitivity analysis" to prove the additionality of the project (NM0142).
- Assumption that the continuation of the current situation is the only possible baseline scenario, resulting from applicability conditions that were too restrictive (NM0109).
- CH_4 emissions due to anaerobic treatment of the removed biomass were not addressed although they can cause significant GHG emissions (NM0108).

In the meantime a solution for the majority of the general deficiencies stated above has been found by at least one of the methodologies. Also it seems to be quite probable that individual errors not sufficiently treated to

[8] See Final Recommendation on NM0069: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=8&OpenNM=NM0069&cases=C#NM0069 [accessed 3 March 2007].

[9] See http://cdm.unfccc.int/public_inputs/meth_doublecounting_biofuels/index.html, [accessed 3 March 2007].

[10] See http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=16&OpenNM=NM0185&cases=B#NM0185 [accessed 3 March 2007].

[11] Due to the many discussions regarding verification of the additionality of a project, the EB developed a tool to provide guidance for the assessment of additionality. The "additionality tool", which has been available since October 2004, contains five steps to be followed by project developers to check if their project meets the additionality criterion. The tool can be downloaded at: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

date will be overcome. But adequate answers are still missing regarding the correct assessment of changes in carbon pools and the problem of potential double counting.

2.2 Efficiency Improvements

As for the second category, efficiency improvements within a transport mode, so far five methodologies have been submitted. While three proposals addressed the public sector, the remaining two methodologies (AMS-III.C.and SSC41), which aim at companies or organisation with a vehicle fleet, could be applied in both the public and the private sector.

Small-Scale Methodology AMS-III.C. was elaborated "top-down" by the EB's SSC Panel that was operational from April 2002 to August 2002 to recommend draft simplified modalities and procedures for small-scale CDM project activities as well as draft methodologies for small-scale projects. AMS-III.C. provides a very basic method for projects aiming at the substitution of conventional vehicles by low-greenhouse gas emitting vehicles such as electric or hybrid vehicles.[12] It is now in its tenth version.

Methodology SSC41 related to training programmes promoting behavioural changes to achieve a more efficient operation of vehicles. It included two main components: training of mechanics to improve maintenance and repair and training of bus drivers with respect to fuel-efficient driving styles. However, the EB decided that this type of methodology was in principle not eligible under the CDM because the measured emission reductions were not directly attributable to the project activity.[13] Therefore, specific difficulties of the methodology are not addressed further in this paper.

The three proposals targeting the public sector concern an improved public transport system and include also modal shift elements. The general idea is to introduce a Bus Rapid Transit (BRT) system for main bus routes in the city centre. The main routes are to be reconstructed as trunk lanes for the exclusive use of buses. Due to the abolishment of left turns for regular road users, buses operating on trunk lanes would not have to stop outside the bus stations, reducing idling time. An additional set of regular buses would operate on feeder lines to many different locations that the main routes do not reach. Emission reductions are to be achieved first of all through the improvement of the bus fleet by replacing old buses. Since the new buses would be less emission intensive and have a higher load factor, emissions per passenger trip would be reduced significantly. Secondly, emissions of the buses shall be avoided by reduced travel time on main routes. Thirdly, the projects hope to induce a modal switch from private vehicles to buses due to the improved service quality (shorter travel time, more convenient buses, boarding possibilities for handicapped passengers, bicycle parking, etc.), which would also cut GHG emissions.

[12] Since emission reductions stem from the different fuel being used in the new vehicles, this methodology can be considered as part of the fuel switch category as well.
[13] See http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_R7MH1V8LYAVH1E0YL5MHL4AA56QIM4 [accessed 3 March 2007].

Difficulties

As in the case of fuel switch, transportation methodologies dealing with efficiency improvements and modal shifts have various project-specific flaws, maybe even more of them. However, there are also general difficulties.

All methodologies had errors concerning the **baseline calculation**. In the case of methodology NM0185 possible alternative developments to the project activity were reduced to those which complied with specific data requirements established in the methodology.[14] NM0052 was basically criticised for not providing a real method to identify the baseline scenario, i.e. baseline determination was too project-specific and could hardly have been adopted by other projects. This methodology derived from the "TransMilenio" Project in Bogotá, Colombia. The project consists of seven phases and although the first phase has already been realised, baseline emissions were to be calculated without taking into account possible emission reductions achieved through the first phase of the project. The Methodology Panel therefore indicated that Phase I should be included in the baseline scenario. Moreover, both methodologies, NM0052 and NM0158, assumed a static baseline, which is questionable as important parameters were assumed to be constant (emissions factors, fuel efficiency, average trip length, etc.) although they might change over time. In addition NM0052 assumed that 10% of the users of the public mobility system would have switched from private vehicles. The number stems from a survey taken during first phase of the project and it is not clear why the number should stay the same. Instead the Methodology Panel recommended monitoring the number. The methodology also did not differentiate between different fuel types used in private vehicles. To calculate emissions appropriately, this also has to be taken into consideration.

In view of the different shortcomings the Methodology Panel concluded that the baseline scenario developed by NM0052 probably would not represent GHG emissions in the absence of the project.[15] Similarly, NM0158 would have tended to overestimate potential baseline emissions. In addition to the applied static baseline, this is due to the assumption that a potential increase in demand would not be caused by the project but would also have occurred in the baseline scenario. Since it is the explicit goal of the project to improve the public transport system and induce a modal shift, the assumption seems to be highly questionable.

Similarly, the **proof of additionality** seems to be difficult. Again, NM0052 was criticised for not providing a method to demonstrate the additionality of the project. It also lacked on clarity why the project would be additional, given that it is already in the second phase and government introduced a number of new policies to facilitate the continuation of the project. Although NM0158 used the "tool for the demonstration and assessment of aditionality", additional guidance how the tool should be used for this particular project category was missing.

Especially in the case of NM0052 the Meth Panel also raised considerable concerns with regard to the **data utilised**. It stated that in most cases the data source was not clear. Moreover, there were data gaps regarding

[14] For Final Recommendation on NM0158 see at: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=6&OpenNM=NM0052&cases=C#NM0052 [accessed 3 March 2007].

[15] For Final Recommendation on NM0052 see at: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=6&OpenNM=NM0052&cases=C#NM0052 [accessed 3 March 2007].

the number of trunk buses, data of vehicle replacement, number of persons transported in the system and data associated with the modal shift. In addition, more measurement was required since too much of the data was estimated. For NM0158 data issues were of minor significance. According to the Meth Panel it is inaccurate to calculate emissions of road works on the basis of construction costs as proposed by the methodology.

Another problematic issue were the **explicit and implicit assumptions** the methodologies contained. Although some assumptions are indispensable to limit complexity and guarantee applicability, the majority of the ones used in the methodologies submitted were questionable. In addition to those assumptions already mentioned above regarding inaccurate baseline calculation, NM0052 and NM0158 did not take the so-called "rebound effect" into consideration, therefore implicitly supposing the effect would not occur.[16] The Meth Panel criticised that this does not meet the criterion of conservativeness and might lead to an overestimation of emission reductions achieved through the project. A further problem stated in the Meth Panels final recommendation on NM0158 was that the methodology assumed that the project would not lead to additional emissions outside the project boundary. The Meth Panel recommended discussing within the methodology in how far emissions might simply be shifted to another area instead of being avoided.

Conclusion

It is obvious that projects reorganising public mobility services, especially if modal shift elements are included, have impacts on various dispersed emission sources. The necessity to consider, evaluate and measure the diverse direct and indirect effects as well as leakages not only hampers baseline development and the calculation of emission reductions, but also considerably complicates monitoring. On the one hand, this results in baseline and monitoring methodologies which are complex and project-specific, thus not really providing an instrument other projects can adopt. On the other hand, there is a serious danger that measured emission reductions are not (only) caused by the project activity as in case of NM0158. The Meth Panel stated that the methodology created a "bubble" under which all changes in emissions would be attributed to the project. However, other changes not connected to the project may happen in the "bubble" at the same time. Presumably measured emission reductions would therefore not at all be caused by the project activity. NM0158 thus faces fundamental obstacles regarding approval and needs a complete revision. A more complex methodology which measures peoples transport behaviour is required.

For this purpose, NM0105, the strongly improved second version of NM0052, envisages to conduct an annual survey of 2,500 customers. The survey would account for alternative transport modes, induced traffic, fuel type, occupancy rate and trip length. Together with counting the number of customers this survey is to provide essential information for calculating the business as usual case as well as the effects of the measures. NM0105 in fact just contained smaller deficiencies, which again mainly concerned the baseline scenario. The Meth Panel indicated that the proportion of passengers who would have used other modes of transport in the absence of the project needed to be calculated in greater detail. The proposal also lacked adequate data for calculating baseline emissions. The Meth Panel recommended improving the proposed draft survey by adding more questions regarding the type of fuel used in private vehicles, number of people per vehicle, etc. Concerning the calculation of project emissions the proposal indicated that specific fuel consumption of

[16] If a project activity reduces traffic on a specific route, the created space may be occupied by new trips undertaken due to the more comfortable road situation. The term „rebound effect" describes these phenomena.

buses could vary by 20% and if so data would have to be rechecked. The Meth Panel remarked that such high variations are in general not acceptable and a conservative value should be used if a range of specific fuel consumption is found. Further, the Meth Panel raised some very specific points, e.g. that a certain formula needed revision.

In general, however, NM0105 was able to eliminate most of the different shortcomings of NM0052 without generating significant new problems and was approved as the first methodology for the transport sector. But in consequence it is now very challenging to define the business as usual scenario and the EB remarked that NM0105 was complicated and required much data.[17]

2.3 Modal Shift

Within the third category – projects aiming at a modal shift – all projects that have submitted methodology proposals are located in the private sector (NM0128, NM0201, SSC58). The companies involved have so far all used trucks to transport raw materials since this is the cheapest option under normal conditions (without CER revenue).[18] The projects propose switching from road to a less emission-intensive transportation mode. In the case of NM0128 and NM0201, the projects aim at transporting feedstock by barges for the main part of the route instead.[19] SSC58 envisages pipeline transportation, which would avoid not only truck transportation but also reduce ship travelling distance significantly.

Difficulties

Compared with the methodologies addressing the public sector discussed above, methodologies of the third category that have so far been proposed are less complex and can be established more easily since most of the effects complicating development of adequate methodologies in the public sector (e.g. measuring people's transport behaviour) are missing in the private sector. Nevertheless, the methodologies so far assessed by the EB all contained substantial shortcomings and need significant revision. While NM201 was submitted to the EB recently and is still under consideration, NM0128 and SSC58 both failed the approval process. Here the great majority of the shortcomings were not general but methodology-specific. Since the shortcomings were substantial, only basic deficiencies are listed in the following.

Methodology NM128

Similar to methodologies in the other two categories, NM128 did not provide an adequate method for **baseline calculation**, either. The methodology proposal assumed that the baseline was the continuation of the current situation without providing a procedure to determine possible alternative baseline scenarios. Moreover, it assumed a static baseline. The Meth Panel noted that at least a change in possible transport mode, effi-

[17] For Final Recommendation on NM0105 see at: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenNM=NM0105&single=1 [accessed 3 March 2007].

[18] In case of SSC58 trucks are used to transport feedstock (Butadiene) to the harbour from where it is forwarded by sea.

[19] Ship transport significantly reduces emissions per unit of feedstock compared to road transport. This is well illustrated by the numbers given in methodology NM0128: a typical truck load contains about 44 m^3 of wood with fuel consumption of 1.65 km/litre, while barge load contains 4,932 m^3 of wood with fuel consumption of 0.0278 km/litre. SSC58 rather reduces emissions by abbreviating overall transportation distance.

ciency and load factor should be considered. Finally, the methodology assumed one year's data to be sufficient for determining the baseline. The Meth Panel remarked that this should be extended to three years.

An undoubtedly significant error was made concerning the **calculation of emission reductions** achieved through the project. The methodology assumed that all emission reductions would be due to the change in the mode of transport for raw materials. However, transport-related emission reductions could also occur if the plant reduced its output or the production process in the plant was changed. These factors were not at all considered in the methodology. To get approved the methodology has to link transportation emissions to plant output.

Furthermore, the aspect of **return trips** was not addressed. Trucks (in the baseline scenario) might carry other freight or freight from another company on their way back, while ships would return empty (in the project scenario). If so, the Meth Panel suggested that return-trip fuel consumption of the trucks in the baseline scenario should not be accounted for. Hence, the methodology has to discuss to what extent fuel consumption due to return trips has to be considered.

As regards **monitoring**, the methodology proposed to annually monitor the amount of fuel transported by the existing transportation mode to calculate baseline emissions. Actually, it does not seem possible to do so since it is the explicit goal of the project to change the current mode of transportation.[20]

Small Scale Methodology SSC58

Although project developers submitted two revisions of SSC58, the methodology did not get approval. Initially, the Meth Panel criticised that the proposed **project boundaries** would cover more than one Non-Annex I country and it was not clear how the methodology would address this issue.

Furthermore, the Meth Panel raised doubts concerning the **additionality** of the project. Because a significant reduction of the transportation distance would reduce transportation costs, the company has an incentive to implement the project even without the CER revenue. In this case the project activity itself would be the baseline. Therefore, the methodology has to demonstrate that the project scenario is not the baseline scenario. The methodology specified barriers preventing the project activity to be realised under common circumstances, that is without the CDM. But according to the Meth Panel it was not evident that the barriers would be removed through the proposed CDM project.

An additional problematic issue related to the **data used to calculate emission reductions**. First, the Meth Panel noted that actual electricity consumption should be used as a priority indicator to calculate emissions, instead of calculating the consumption in accordance with another approved methodology. Furthermore, electricity use for pumping water to flush the pipeline was not taken into account. And, similarly to NM1028, the load factor was not addressed adequately. For the trucks used in the baseline scenario a uniform fuel consumption figure was assumed. However, if the trucks return empty, their fuel consumption probably decreases. And if trucks carry any freight on their return trips, it has to be discussed whether or not return-trip fuel consumption must be excluded from the baseline (see also above).

[20] For the final recommendation on NM0128 see at: http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html?OpenRound=12&OpenNM=NM0128&cases=C#NM0128 [accessed 3 March 2007].

Finally, the methodology did not properly account for **leakages**. In particular emissions related to the construction of the pipeline were not included. Also, in the project case the transportation medium would have a very low utilisation rate. Leakage might therefore occur if the transport medium was used for other products. Another potential source for additional emissions which should be treated as leakage regards the trucks used in the baseline scenario. They could potentially be transferred to other activities, causing (additional) emissions there. The Meth Panel pointed out that the issue at least has to be discussed within the methodology.[21]

3 Summary and Conclusions

The CDM is now fully functional and expanding rapidly. Currently, more than 1,700 projects have been registered or are at the validation stage. However, the share of transport projects is negligibly small. Up to now only two transport projects are at the validation stage. The underlying reason is that so far only two methodologies for baseline establishment and monitoring have been approved, which is a prerequisite for submitting projects for registration. Eleven other transport projects have submitted proposals for new methodologies to the EB. However, none of these have so far been approved. In some cases, methodologies have been going through revisions for several years now.

This paper therefore aimed at analysing the methodology proposals to determine whether the low rate of approval has been due to flawed methodology proposals or due to fundamental problems connected to the nature of transport projects. As a first step, projects were grouped into three categories: fuel switch, efficiency improvements and modal shift. For each category common and project-specific reasons for non-approval were compiled.

The fuel switch methodologies submitted so far contained a large number of different shortcomings. The analysis shows that the great majority of both the common and the project-specific shortcomings are not fundamental and a solution for each of them was found by at least one of the methodologies. However, regarding the correct assessment of changes in carbon pools and potential double counting, so far none of the methodologies could provide a sufficient solution. Nevertheless, the EB will probably agree on approaches to deal with both matters in the near future. It can therefore be concluded that fuel switch methodologies in the transport sector are relatively straightforward and do fit well in the present CDM once the basic uncertainties still existing are resolved. In fact, one small scale methodology already received approval, a further methodology is close to being approved and others seem to be on track as well.

So far only a few projects dealing with efficiency improvements have submitted a methodology to the EB. Most of the shortcomings identified relate to the specific project. Nevertheless, some general points could be identified where the development of an adequate methodology seems to be especially complicated.[22] First of all the method for baseline establishment was not appropriate. Secondly, vital assumptions made by the proposals could not have been verified or were questionable. Thirdly, the proof of additionality was too project-

[21] For the response to SSC58 see at: http://cdm.unfccc.int/methodologies/SSCmethodologies/Clarifications/index.html [accessed 3 March 2007].
[22] The following shortcomings do not relate to NM105 and AMS-III.C. since both methodologies are now approved.

specific and could hardly have been adopted by other projects. No real method to determine additionality was provided. However, all these problems do not point to fundamental obstacles but rather resulted from weak methodology proposals.

NM105 was finally able to overcome all general and project-specific uncertainties and has now been approved. However, the methodology is very complex and project specific. It is obvious that the development of an adequate methodology for projects in the public sector is more challenging than for projects in the private sector. It requires much know-how, data, time and also money. The fact that so far just two projects have submitted methodologies to the EB can be seen as an indicator of the high complexity and expense which are linked to this sort of project.

Methodologies that have so far been proposed in the third category are less complex. While both methodologies that have so far been evaluated by the EB failed the approval process due to fundamental project-specific shortcomings, here as well these shortcoming were the result of weak methodology proposals rather than fundamental obstacles

In all three categories methodology development has been a long and complicated process. Most of the methodologies currently under consideration had been submitted to the EB for the first time in 2004 or 2005 already. It can be concluded that the main reason why there are so far only very few transport projects in the pipeline is their high complexity. The analysis further shows that the development of transport methodologies is especially complicated if the project is located in the public sector. In particular this holds true for methodologies that also contain modal shift elements since it requires evaluating and monitoring people's transport behaviour.

Nevertheless, in principle it seems possible to develop adequate methodologies in all three categories. Therefore the small number of transport methodologies currently under consideration does not point to an insurmountable problem. Rather, due to the high complexity of transport projects methodology development needs a lot of time, but once the first methodologies in the transport sector have clarified most of the uncertainties more projects and also new methodologies will probably follow. One of the reasons why methodology approval has been so much delayed is that the methodology proposals were very weak to begin with.

Fuel-shift projects seem particularly suited to the CDM since here the project activity can be clearly defined. The same would probably hold for projects aiming at technical improvements of specific vehicles. And while emissions accounting is very complex for projects in the public sector, the Bogotá bus rapid transit system project has nevertheless shown that here as well it is possible to get a methodology approved.

Moreover, in the past and also currently methodology developers have preferred to target the so called "low hanging fruits" (e.g. methane capture/combustion projects), i.e. projects that generate huge amounts of CERs at comparatively low costs. Once these sources of cheap CERs have been exhausted, other sectors such as transportation potentially will gain more attention.

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The positions expressed in this paper are strictly those of the authors.

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http://www.wupperinst.org/en/projects/project_details/index.html?&projekt_id=96&bid=170

Annex: Overview of Transport Methodologies Submitted to the CDM Executive Board

	Modal Shift (private sector)			Efficiency Imp. (+ Modal shift)		Efficiency Improvements	
	Change from road to sea transport	Change from road to pipeline transport (SmallScale)	Cosipar Transport Modal Shift Project	Transmilenio – urban mass transportation system	BRT project, Mexico	Behaviour-oriented demand-side EE program (SmallScale)	Emission reductions by low-greenhouse gas emitting vehicles (Small Scale)
Method N°	NM128	SSC58	NM201	NM52 105	158	SSC41	AMS-III.C.
Country	Brazil	India	Brazil	Colombia	Mexico	Thailand	India
Main Characteristics	- Idea: increasing transportation efficiency - Aim: switching from road to a less emission intensive transportation mode - NM0128 + NM0201: transport of feedstock by barges instead of trucks SSC58: transport of feedstock by pipeline/ship instead of truck/ship			- Aim: introduction of BRT system for main bus routes - Emission reduction through: 1. improvement of the bus fleet by substituting old buses 2. reduction of idling time 3. induction of modal switch from private vehicles to buses		- Training of drivers promoting behavioural measures for energy efficient operation of vehicles	- Substitution of conventional vehicles through low-greenhouse gas emitting vehicles
Main Meth Panel / EB criticism	- A static baseline is used - Transportation emissions are not linked to plant output - Return-trips are not addressed - Flawed proof of additionality		- Not yet assessed	* - Baseline scenario probably will not represent GHG emissions in the absence of the project - A static baseline is used Project-specific proof of additionality without providing a *method* - Questionable assumptions used (e.g. that "rebound effect" is negligible)		- "not eligible in principle" since measured emission reductions are not directly attributable to the project activity	-
Expected CERs	63,799	63,210	47,172	3,332,859	181,209	-	59,000
Stage of Approval	Method Not Approved	Method Not Approved	Method U. Consideration	M. Approved, Project Under Validation	Method Not Approved	Method Not Approved	Method Approved, Project Under Validation

* Indicated difficulties only hold for the methodologies NM52 and 158.

	Fuel Switch											
	Switching fossil fuels from petro-diesel to biodiesel in transport sector		Transportation bio-fuel production with life-cycle-assessment		Khon Kaen fuel ethanol project		Palm methyl ester biodiesel fuel production for transport using LCA	"A road transport sector fuel switching project" (LPG retail outlets for cars)	Biolux Benji Biodiesel Beijing Project
Method N°	NM69	108	109	129	82		NM142	NM83	NM180
Country	India		Thailand		Thailand		Thailand	India	China
Main Characteristics	- Idea: substitution of conventional diesel or petrol through less emission-intensive fuel, mainly biofuel - Aim: cultivation of energy plants, production and distribution of biofuel - Assumption: biodiesel is "carbon neutral" and substitutes conventional diesel in motors, in consequence GHG emissions are avoided							Substitution of conventional diesel through less emission intensive LPG	- Production and sale of biodiesel produced from waste cooking oil (see also below)
Main Meth Panel / EB criticism	- Wrong (or no) assessment of decrease/increase of "carbon pools" due to project activity or in the absence of the project - Adoption of (LCA) emission factors not applicable to the project - Incorrect treatment of leakages concerning: • possible export of biofuel to Annex I countries • N_2O emissions due to application of fertiliser • change in fuel efficiency due to use of biodiesel							- Baseline scenario overestimates GHG reductions achieved by the project activity - Monitoring methodology is not adequate	- Not yet assessed
Expected CERs	120,696		442,170		401,960		2,177,550	2,542,723	123,211
Stage of Approval	Method Under Consideration		Method Under Consideration		Method Under Consideration		Method Under Consideration	Method Not Approved	Method Under Consideration