Impact Evaluation

Public-private Partnership BSH / GTZ

Clean Development Mechanism für Steigerung des Anteils an energieeffizienten Kühlschränken in Haushalten in Brasilien

Chapter 1: PPP Implementation

Chapter 2: Impact of the PPP results and definition of future CDM work

1.1 The initial situation of BSH and the potential interest of CDM projects for household appliance manufacturers

Not included in public version

1.2 Assessment of the effectiveness of the 21 activities planned for the PPP

Planning for the PPP consisted of a list of 21 different activities with 17 respective indicators for their achievement (the "Statusbericht" in GTZ jargon). The activities were designed following the typical CDM project cycle without putting them in a timeframe or a sequence. The planning was thus a collection of potential activities necessary that did not prescribe how these activities should build upon each other. This type of planning was chosen because it was not possible to predict regulations by the UNFCCC and the Brazilian DNA nor the concerns of the Brazilian utility companies while it was possible to define an overarching goal combining the objectives of GTZ-Proklima and those of BSH.

With hindsight the different activities' effectiveness and their justification can be qualified.

1.2.1 Activities to prepare CDM projects

Ideally, all relevant parameters for the participants are known. In particular, households which receive a new refrigerator should contribute to the cost in relation to their ability and their benefits from a new refrigerator and the utilities should contribute to the extent that their cost to service their clients is reduced. Most of these parameters were unknown and the PPP used available information to extract crucial insights. These insights are necessary for the CDM proponent to make a commercial offer to a utility. Part of such an offer must be an estimation of the expected number of households and the income from CERs. To create an influential precedent CDM project, it was important to clarify whether by choosing a particular type of household or a particular type of Favela or city that CDM project could perhaps demonstrate favourable and above average CER income and household participation.

Result 1 Activities

- Compilation and comparison of socioeconomic data for low-income households in Brazil
- Inclusion of local researchers for the definition of refrigeration data
- Marketing study Marktpotenzialanalyse (market segments and consumer behaviour) and elaboration of financing models
- Define catalogue of criteria for the identification of implementation partners (civil society and NGOs that might exchange refrigerators)
- Analysis of the cooperation with Brazilian utility companies in the CDM implementation and advice to BSH for the selection of potential utilities

Source: PPP Statusbericht GTZ

Socioeconomic statistics are available in disaggregated form in Brazil but as frequently the case, they cannot be directly used as CDM project parameters. In Brazil, the household income variation in Favelas is always a function of the age of the Favela. Households budgets allow to model households expenditures for each income class. Similar detail about electricity bills is also available. All available statistics show that more than 90% of low-income households in Brazil have refrigerators, irrespective of the poverty level in a Favela. For the design of a CDM project, household data must be specific to the appliance, what share of the electricity bill is the refrigerator, how often is one purchased, for what price, where etc., and this information is not available.

One Brazil specific factor is the dominance of appliance retailers, especially the largest one Casa Bahia. These retailers have outlets in large Favelas and low-income households are a captive consumer class for these retailers and therefore information about appliance purchase behaviour is proprietary for these monopolists. Casa Bahia provides finance for 75% of all appliances it sells. An efficient manner to address this is to include Casa Bahia in the preparation of CDM projects since Casa Bahia would probably see the potential to increase sales. PPP efforts left this question for later and then didn't manage to address it.

A related issue is the use of a micro-credit approach and a related Brazil specific condition is the absence of micro-credit institutions in Brazil. In part this absence is an effect of Casa Bahia's capacity to offer low-income households payment schemes and many households in Favela have Casa Bahia credit cards that allow these households to buy appliances such as TVs.

Major Data Sources Used:

De Melo C and GM Jannuzzi (2008) O estoque de refrigeradores no Brasil: diferencas e semelhancas regionais por faixa de renda, *Espaco Energia*, 8: 20-27.

Eletrobrás (1998) Pesquisa de posse de eletrodomésticos e hábitos de consumo, Eletrobrás, Procel, PUC.

ESMAP (2006) How do the Peri-urban Poor Meet their Energy Needs: a Case Study of Caju Shantytown, Rio de Janeiro, ESMAP Technical Paper 094, Washington DC: IBRD.

Fundacao Pinheiro (2006) Deficit Habitacional no Brasil.

IETS (2001) Estudo sobre o custo econômico da Energia Elétrica para as populações de Baixa Renda do Rio de Janeiro.

Light (2007) Pesquisa de Posse de Eletrodomésticos e Hábitos de Consumo (PPH), Rio de Janeiro.

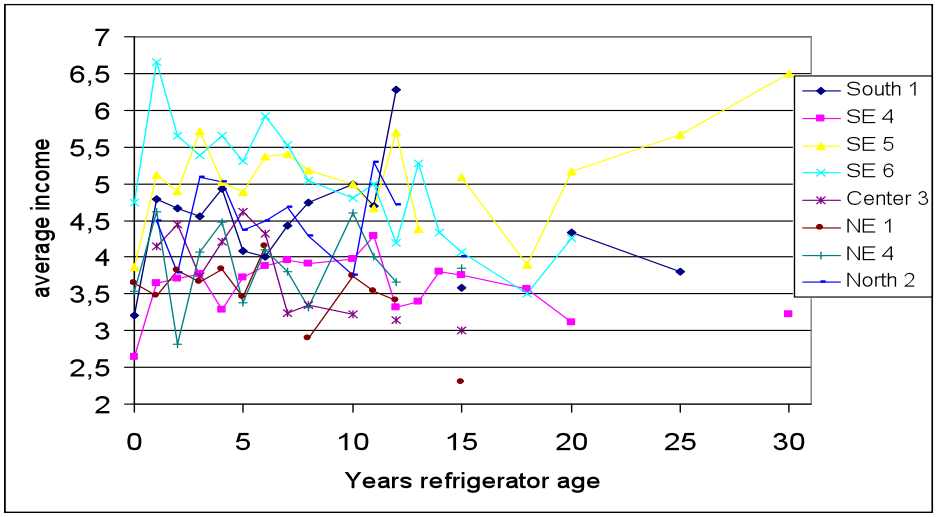
Overall the conclusion from these sources was surprising and justified that the PPP did not pursue new data generation. The overall conclusion was that neither age nor energy consumption of household refrigerators in Favelas correlate with income. This conclusion was effective but in principle should not be used again and instead be verified in a systematic manner.

For this conclusion to be fully valid a couple of unlikely conditions need to exist. First, the second-hand refrigerator suppliers are not aware of refrigerator performance criteria and/or do not offer different quality models at different prices. Second, households that do not purchase second-hand refrigerators collect these from employers or relatives and these are in similar average conditions than those in the second-hand market.

If these conditions are indeed valid, then it is not possible to design CDM projects for specific low-income households classes or specific Favelas. This would be a significant limit for CDM development because even when a CDM project offers different participant conditions for households to choose from, still in many cases their choices might not be optimal and thus the overall CDM performance limited.

The Eletrobrás survey covers 10.000 households in random samples from 21 utility companies across Brazil. Structuring the data according to refrigerator age groups revealed that there is no correlation between age and average income. The following Figure 1 shows the results for those utilities (each graph is one utility) where most households in the samples gave the income information to the surveyors (for example North 2 is shown because 315 out of 400 households indicated their income level, whereas in North 3 only 100 out of 400 did this, and thus only North 2 is included here). Procel does not allow to reveal utility names (an indicator of the regulatory practice in Brazil). The households with older refrigerators have more incentive to participate in a refrigerator exchange, however, no income group offers higher CDM return in the form of CERs.

Figure 1



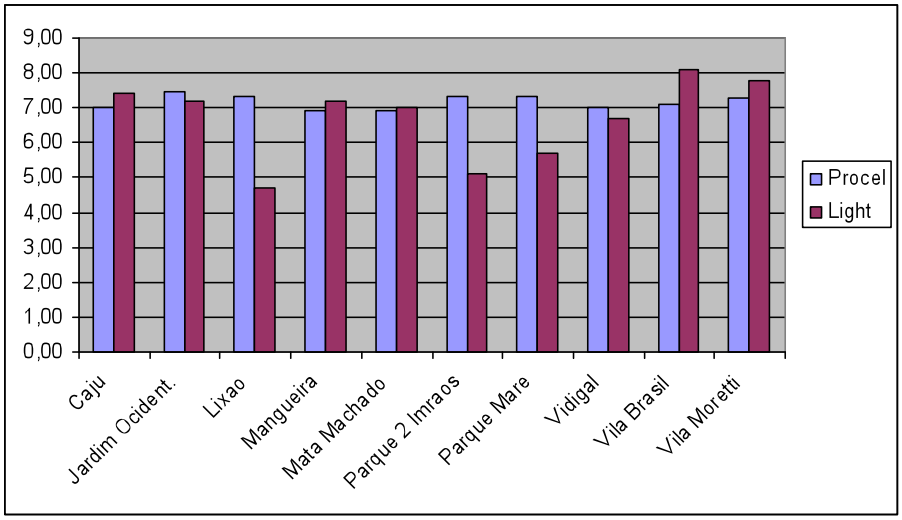
Some differences appear between Southeast utilities since SE6 shows that average income decreases with increasing refrigerator age, from over SM6 to under SM4.5 for refrigerators older than 15 years. To the contrary SE4 has a rising slope until refrigerators of 10 years.

For CDM design purposes, these statistics can be approximated and general mathematical expressions derived. For example, for refrigerator age:

Age = 8.08 - 0.36 * Income (SM) Center West region

However, these results were not useful for the implementation of the PPP but this allowed to cross-check the Eletrobrás results with a 2000 household survey of the utility Light in Rio de Janeiro from 2007. The latter comprised results for 10 different Favelas in Rio that where chosen to represent the variations among all Favelas. The following Figure 2 illustrates the average refrigerator age reported by Light and those calculated from the Eletrobrás / Procel survey. The correlation is quite good and therefore there was no indication that the PPP might achieve a better CDM design by generating new socio-economic data.

Figure 2



The Light survey also included detailed data about TVs, freezers and other appliances, dwelling surface size, education and electricity bills. A factor analysis of these details (see chapter 2.3) showed the well-known result that education is the best predictor of income, an indication that the data is consistent. The presence of old refrigerators is an outlier variable in the factor analysis, also an indication for the hypothesis above about the second-hand refrigerator market.

An evident starting point for future work is the household typology proposed in the ESMAP study, led by Prof. Adilson de Oliveira from Rio university. It suggests four types of households based on a mix of variables because disposable income is not suitable in low-income households as income is sporadic and poverty implies other asset categories. The study concluded that “D” households do not use “gatos” (power theft) and thus pay similar electricity bills than “A” and “B” households whose amount they control only by switching refrigerators off at night.

Table 1

	Appliance usage	Economic situation	Bill / consumption varies when
A > SM5	usage not affected by electricity bill	Formal employment by head of household, access to credit, bank account and credit card	efficiency changes, new appliances
B < SM5, > SM3	usage not affected, but more appliances would create this	Formal employment Credit limited	
C < SM3, > SM1	usage sometimes constrained	Informal employment No access to credit	
D < SM1	usage always constrained	informal employment No credit	only when income changes

This typology represents different levels of energy poverty in one Favela, but it could be suitable for most Favelas. A CDM project design could include three or four sets of participation conditions for households so that household contribution and benefits in the CDM project reflect better the socio-economic situation in low-income households.

The overall conclusion about the effectiveness of Result 1 activities is that the economic conditions for the participation of households in a CDM vary so much that CDM design must distinguish household classes and thus that these activities are essential. For the case of the PPP however, there is no correlation between household income and the refrigerator efficiency and therefore the PPP could not improve its impact by attempting to target specific Favelas or household classes. It was justified to not undertake efforts to create new socio-economic data for the CDM design. At the level of the offer by BSH to a Brazilian utility, it is not possible to predict CER income because of the non-correlation of efficiency with other household conditions. But at the level of the individual household towards the CDM project further work can substantially increase the impact of CDM projects.

1.2.2 Activities to produce and submit CDM project documentation

This was the major focus of the PPP because the unpredictability of the CDM approval is often an important factor for CDM. The quality of PDDs is difficult to ascertain for a CDM project proponent and in Brazil several failed submissions are well known. The PPP itself could not act as a CDM project proponent since this was necessarily up to an agreement between a utility and BSH. Nonetheless, the PPP produced several PDDs and gave these to the utilities Coelba, CEMIG, CPFL and to the Brazilian DNA. The most influential PPP activity was the refrigerator

methodology and the usability of this methodology is the most important means to affect the CDM approval in general. Clear CDM parameters, easy and cheap to measure and to verify, functional division of tasks in implementation, are the characteristics of a CDM methodology that lead to its frequent application.

Result 2 Activities

- Stakeholder dialogue for the CDM project and its design
- Creation of a CDM methodology that leads to the highest CER income per refrigerator
- Produce a PDD and PDD verification by the DOE
- Submit PDD to the Brazilian DOA
- Review of the methodology by DOE
- Submit methodology and approval by the UNFCCC

Source: PPP Statusbericht GTZ

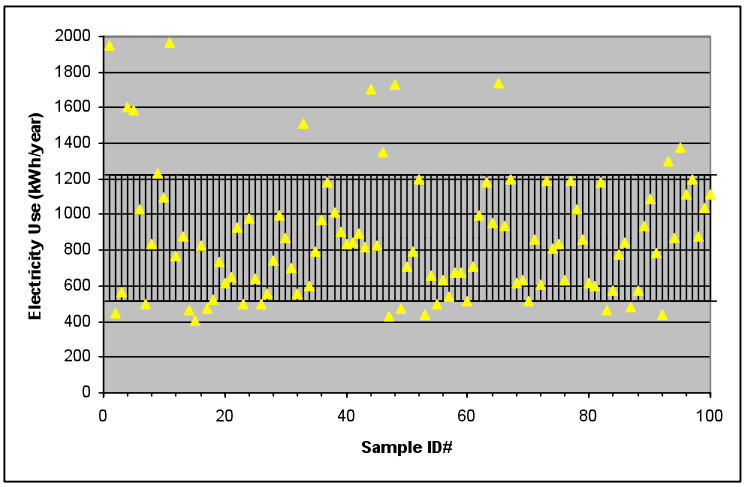
During the PPP activities, the utility Coelba submitted two PDDs for the refrigerators it exchanged in Favelas of Salvador, Bahia:

http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/293/COELBA%20PDD.pdf
http://cdm.unfccc.int/UserManagement/FileStorage/F8MDHX301B5HP7S6D5E9UROX7GEBMG

Both submissions failed and the DOE could not produce a positive validation report on them. The second one was submitted on 29 July 2008, just after the PPP had submitted its methodology proposal (NM012 appeared on 17th July 2008). Both Coelba PDDs used the standard small-scale methodology AMS II.C that is generic for any energy efficiency improvement and has no prescription for monitoring. The new refrigerators in both PDDs were from BSH. Coelba had announced during a conference of the utility association in September 2007 (Associacao Brasileira de Distribuidores de Energia Electrica, 7. Encontro de Eficiencia Energetica e Pesquisa e Desenvolvimento da ABRADEE, 24-25. September 2007) with all Brazilian utility companies present that Coelba would cooperate with the PPP. And indeed, Coelba was negotiating with BSH throughout the PPP acitivities until the sale of BSH Brazil. It is not known whether Coelba submitted these PDDs independently because they did not want to wait for the NM012 methodology, or because they preferred to keep BSH only as refrigerator supplier, or because the offer BSH made on refrigerators as part of a CDM project was not attractive, or because Coelba felt that its own Brazilian consultants would provide higher quality PDDs. Coelba showed its two PDDs to GTZ-Proklima prior to submitting them and in both cases GTZ-Proklima commented to Coelba in writing.

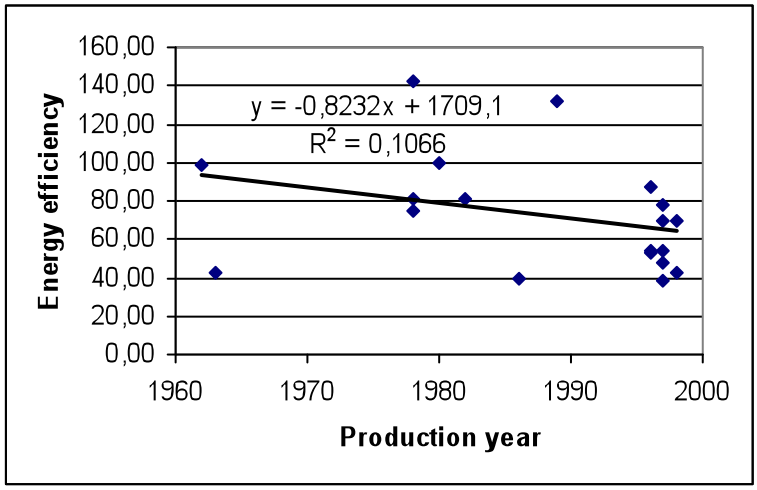
Clear CDM parameters, easy and cheap to measure and to verify are the factors for the usability of a methodology. The PPP produced a methodology (AMS III.X) that does not require any measurement in the households. This is the most important characteristic and it reduces Coelba's most important problem with its two PDDs. In order to prepare AMS III.X, BSH selected a random sample of old refrigerators from Favelas and tested these. The following two graphs show the results and these two were used to submit the methodology (NM012 had a PDD with sections A-C as illustration as required by the UNFCCC):

Figure 3



The standard variation is the horizontal band and shows that the required statistical accuracy can be achieved by measuring such a random sample of 100. Furthermore these tests showed that the average age is not correlated, the correlation coefficient below is Rsquare = 0.1066. This result of BSH's measurements strengthens the conclusions from Result 1. When the efficiency of refrigerators does not correlate with the age, then the second-hand market could still have some quality/price differentials and those households with more income buy more expensive second-hand models than other, but these differences reflect only aesthetic qualities.

Figure 4



These two results convinced the SSC Working Group that no in situ measurement was necessary. Other factors in the approval of AMS III.X, that led to the swift approval of AMS III.X in only 5 months, are discussed later on in chapter 1.8. For the effectiveness of the CDM project documentation activities, these two were crucial.

The methodology has so far been used only once and independently of the PPP activities. The utility company in Sao Paulo, Eletropaulo, submitted a PDD with AMS III.X on 5. September 2009:

http://cdm.unfccc.int/UserManagement/FileStorage/AOWYEU1VQMFJ46G2I9LKTDRH0SPX3Z

It describes the exchange of 12.000 low-income household refrigerators in Favelas of Sao Paulo, the new ones are from Whirlpool and comply with the eligibility criteria of AMS III.X. This PDD copies all variables from the PDD with sections A-C that was

submitted with AMS III.X. Therefore both products of the PPP, the methodology and the PDD have been used independently of the PPP activities. So far no other CDM project documents for refrigerators have been submitted in any other country. If the Eletropaulo PDD is approved, registered and CERs issued, then the PPP activities would have effectively established a standard for household refrigerator CDM. This will be known about one year after the Eletropaulo submission, in fall 2010.

The final PPP product is a Programme of Activities CDM, the so-called PoA-DD and the CPA-DD. These were not part of the planned PPP activities, but when the UNFCCC issued regulations for PoAs, it was decided that submitting CDM project documentation of this new type would have equally trend-setting influence than a refrigerator methodology. The PoA format has been discussed in the UNFCCC's CDM Executive Board for a long period and it was not certain if it would ever come to a final approval.

During the meeting with BSH, CEMIG and CPFL in February 2008, a member of the Brazilian DNA, Mrs B. Americano, responded that the DNA would appreciate receiving a PoA-DD informally because it was considering issuing specific PoA regulations for Brazil. The PPP therefore produced a PoA-DD with the standard AMS II.C methodology to assist the DNA. This was sent to the DNA in March 2008. The Brazilian DNA did not react and when asked one year later, responded that no further PoA input was needed. It is not possible to ascertain whether this activity was effective towards the PPP's objectives. Statements by the head of the Brazilian DNA during the UNFCCC CDM Executive Board meetings indicate that he was receptive to the potential of PoA to expand CDM in energy efficiency and in households. It is thus possible that the PoA-DD submitted informally supported the Brazilian DNA's judgement of PoA. The first PoA-DD submitted to the UNFCCC appeared on 22 February 2008, for biogas digesters from Sadia in Brazil. The Brazilian DNA has so far not issued any PoA specific regulation for Brazil.

Later, the UNFCCC's Executive Board further clarified the PoA-DD procedures and format. During the 47th Executive Board meeting in May 2009, the crucial regulations simplifying the submission of PoA were approved (EB47 Annexes 29 to 32). The PPP then produced a PoA-DD and CPA-DD with the newly approved AMS III.X where "Mabe Hortolândia Eletrodomésticos Ltda." is both the managing entity and the implementing entity, to be realised with Coelba in Salvador. This PoA-DD and CPA-DD were given to Mabe for negotiation with Coelba but this negotiation is still ongoing and it is not possible to predict the outcome.

Given that Coelba's two PDDs were not successful and that Mabe offers the most efficiency refrigerator (BSH technology) at 15 kWh/mo. compared to current top models at 24 kWh/mo. it should only require an agreement of the price and division of the CDM registration cost between Mabe and Coelba. Coelba stated to Proklima that their appreciation of Mabe is lower than that of BSH and that Coelba still pursues their commitment (since 2004) to pioneer the use of CDM for household refrigeration in Favelas.

Qualifying the effectiveness of the PPP's Result 2 activities, these activities are first of all marked by their innovativeness. The methodology AMS III.X and the PoA are both very specific to household refrigerators and depart considerably from comparable tools, the methodology AMS II.C and the PDDs produced elsewhere.

This is a risky strategy. When AMS III.X and the PoA are indeed replicated then these activities exert significant influence on the emerging trends in CDM. At present, this is the case because the only CDM project for household refrigerators that is submitted to the UNFCCC uses the methodology AMS III.X but it is not yet possible to determine whether this impact will last and gain its full strength.

Finally it should be underlined that there was little choice because Coelba had stressed its intention to be the front runner for CDM and this was passively accepted by the other utilities (all are exchanging some household refrigerators in their Favelas in small pilots). Result 2 activities all depended on BSH and Coelba to come to an agreement and their negotiations were ongoing throughout 2008 and 2009. The alternative was to disregard this and for Proklima to push independently toward a different utility than Coelba. Whether this was feasible depends on the Brazilian utilities' "herd effect". However, it should also be considered that if BSH applies the AMS III.X and the PoA in a different country than Brazil, the effectiveness benefit to the PPP activities would be the same.

1.2.3 Activities to assist BSH in Brazil in local CDM development efforts

An important assumption for the PPP activities was the division of work between BSH and GTZ. This division was seen as largely obligatory because of contractual responsibility and because of CDM regulations. The former reflects that through a CDM project the proponent is undertaking financial obligations and risk and neither of the two could possibly be shared between BSH and GTZ even purely on legal grounds. It would have been necessary to create a formal legal entity to act as project proponent and this would have created many other difficult policy issues besides innovating CDM projects in low-income households. Secondly, no ODA funds are allowed to be used in CDM project implementation and so it was necessary to assure that no Proklima funds contribute to implementation cost. ODA funds are only allowed to support CDM preparation as was indeed the case here.

Given this situation, the PPP activities could comprise advise to BSH on how to approach the other organisations involved in the CDM project development and suggest potential solutions for their collaboration. The transaction cost are significant and trial and error is costly, therefore clear orientation can be quite beneficial. Since BSH was the sole project proponent, all contacts with utilities were led by BSH and Proklima remained passive. Proklima provided elements of judgement to be used in the offer to utilities, but never asked BSH to take any specific action or give Proklima particular information on BSH's contact to utilities. This passive role of Proklima in the initiatives in Brazil was also suitable because of the relation between BSH Germany and BSH in Brazil, whose brand name was Continental. BSH Brazil was an independent company and BSH Germany had no operational control. Within BSH Brazil the ability to act independently was a goal in itself although with considerable ambiguity. This led the person responsible for CDM in Brazil to resign in mid-2008, get hired again as a consultant and finally leave at the end of 2008. His replacement was a young engineer with quite different qualifications. BSH's efforts to hire staff with CDM experience in Brazil were not successful.

Result 3 Activities:

- Identify one or several Favelas and NGOs for the CDM project implementation
- Contractual agreement between BSH, NGO and utility
- Include other local institutions in the implementation
- Identify local company for the recycling of old refrigerators

Source: PPP Statusbericht GTZ

In the first half of the PPP, a survey of NGOs in the city of Curitiba was contracted because at that time the emission factor regulation by the Brazilian DNA was particularly favourable in the Southern region. The survey required competence in CDM and experience in the Brazilian NGO environment and it was directly contracted to REDEH a small NGO headed by Thais Corral, who also acts as capacity director in Southsouthnorth, an prominent international NGO in CDM. Southsouthnorth is also a key contributor to the Gold Standard and could thus advise BSH if Gold Standard certification were to be pursued. The study was delivered in February 2008. The focus was:

- Inventory of forms of energy assistance in Favelas
- Overview of NGOs
- Characteristics of the most respected Favela association support organisations

Offering new refrigerators to low-income households is a source of local political capital and access conditions to Favelas are problematic. An overview of local partners is necessary and the study was designed to provide information so that the first approach of a local partner was precise. Even so the location of the CDM project might change later, it was felt that BSH needed experience in how to conduct his preparation. It would also have been possible to get such a study for the city of Salvador, however it might have interfered with the BSH – Coelba negotiation and furthermore Coelba has always worked with an NGO called AVSI and would not have wanted to change its cooperation with AVSI because of AVSI's strong local reputation.

The main result of the study was the extensive assistance by state bodies such as COHAB and the resulting limited role for NGOs. Only five NGOs are active in several Favelas in Curitiba but none would be suitable to play a role in a CDM project:

Table 2

FAS – FUNDAÇÃO DE AÇÃO SOCIAL - LIST OF SOCIAL ORGANIZATIONS WHICH WORK SIMULTANEOUSLY IN MORE THAN 3 AREAS OF IRREGULAR OCCUPATION (FAVELAS)	
Pastoral da Criança, Organismo de Ação Social da Conferência Nacional dos Bispos do Brasil – CNBB Endereço: Rua Jacarezinho, 1.691-Mercês - CEP: 80810-900 Presidente: Dom Aloysio José Leal Penna	Actions for the survival and development of children aiming to improve the quality of life of their families and their physical, social, mental and spiritual health.
Associação Rogacionista de Educação e Assistência Social Endereço: Rua Augusto Steembock, 51 – Uberaba Presidente: Osni Marino Zanatta	Develops social projects focusing the families, giving priority to families already benefited by income transfer programs and / or those in risk or vulnerability situation in Regional Cajuru, como Vila Audi, Jardim Icaraí e Jardim Alvorada.
Jovens Com Uma Missão - JOCUM Endereço: Rua Capitão Leonidas Marques, 3.649 - Uberaba CEP: 81550-000 Presidente: Laurenildo Rodrigues Santana	Social and educational activities with families and extra curricular activities with children and teens in areas of the Regional Cajuru.
Associação Missionária e Educativa de Santa Ana Endereço: Rua Ten. Cel. Benjamin Lage, 570 – Uberaba CEP: 81580-300 Presidente: Maria Cristina Avanço	Develop social and education activities with families at risk and extra curricular activities with children and teens in areas of the Regional Cajuru such as Vila Audi, Jardim Iacaraí, Jardim Alvorada e Jardim Itiberê
Voice For Change Endereço:Rua José Eurípedes Gonçalves, 149 - Jardim Social CEP: 80520-490 Presidente: Willian Lyle Rotert	Social and educational activities with families and extra curricular activities with children and teens in areas of the Regional Cajuru. around Vila União.

The utility company in the state of Paraná, COPEL, had been contacted by BSH and did not respond to the invitation to explore the CDM potential. The REDEH study allowed BSH to also get more information on COPEL's assistance to Favelas:

> In the development of Efficient Energy I, COPEL carried out 500 presentations, 60.000 diagnoses and distributed 1.800 refrigerators. For 2008 COPEL aims to make 500 presentations, 40.000 diagnoses and to distribute 5.000 refrigerators (prognosis), with the same methodology. For delivering the new refrigerators and collecting the old ones, COPEL has opened a bidding process which was won by Marko Eletro Comércio Ltda and the refrigerators donated were from Continental – a subsidiary of Bosch.

COPEL has an agreement with the state of Paraná that low-income households participating in the Bolsa Familia programme and that legalise their electricity use have their electricity bill paid by the state. The study also revealed that the old refrigerators collected by COPEL were stored and no preparations for their disposal had been made.

An indicator for the study's quality is that BSH then contracted Thais Corral to prepare the stakeholder consultation for the CDM project. Following strong political criticism in Brazil, the emission factor regulation was changed three months later and a uniform emission factor across Brazil is since in use. The specific results of the Curitiba study were therefore not useful any longer since a – other Brazilian cities are more attractive for CDM projects in low-income households and b – COPEL continued to not respond to proposals from BSH to consider the potential of a CDM

project to expand the refrigerator replacements. Besides the specific results, the study illustrated how Favela level NGOs activities vary depending on local public service providers. In order to strengthen this insight, it would have been effective to repeat the exercise in another city.

Other major inputs from to BSH that could have assisted BSH to identify operational arrangements suitable in the local context were:

Januar 2008 – Retail versus Utilities CDM
Clarified differences in implementation risks, PoA practicality, additionality and potential scope; stressed that target customers do not overlap

Januar 2008 – CDM Business Model Gaps
Recommended that BSH offers to absorb those risks utilities worry about – monitoring fees and costs and suggests criteria towards Bolsa Familia that utilities would not be able to demand; defined variables that BSH should request from utilities and how to factor them – non-payments, theft and subsidies; CER income sharing proposals

February 2008 – CDM Costs & Prices
Estimates for all cost items of the CDM project cycle, CER / VER price trends

February 2008 – Utility CDM Concept Note
Outlines implementation steps based on typical DSM programmes by utilities

December 2008 – PoA geography
Differentiates a Brazil-wide PoA from a utility-wide PoA and suggests respective features that utility companies might find attractive and a sequence of such offers

January 2009 – Practicable PoA design
Suggests one division of tasks between managing entity and implementing entity and lists possible advantages and disadvantages for the utility, crucial parameter is whether the utility wants to have operative control of the decision whether particular households are eligible or not

May 2009 – Comparison PoA versus standard CDM
Cost differences, crediting periods, start date of accruing emissions

May 2009 – PoA Institutional Roles
Differences between managing entity and implementing entity, which roles suits BSH and which utilities, implications for issuance of CER

June 2009 – PoA writing advice
Suggests which parts of the PoA-DD and CPA-DD should be prepared for the utility, when missing variables are defined, operational details to be included in a BSH – utility contract, how to use it in the stakeholder consultation and when to submit PoA-DD and CPA-DD to a CDM verification service provider (DOE)

BSH used these nine inputs and did it query any particular aspect of them. Typically, these inputs were discussed during the numerous telephone conferences. Given that there is little prior experience in CDM project preparation for low-income households in Brazil and worldwide, this is insufficient because undoubtedly these inputs were not complete or failsafe instructions. It would have been more effective if the Brazilian employees of BSH had made more active use of Proklima's advise. Especially in the person of Anne Arquit Niederberger, Proklima offered access to expertise that only comes from those involved in the CDM negotiations during the Conferences of the Parties of the Kyoto Protocol. All PPP activities were informed from this expertise, but there was no instance where someone from BSH in Brazil formulated a specific problem, reflecting the particular situation of a Brazilian utility, and queried how this could be addressed.

The discussion of Brazilian implementation conditions was most effective during the two-day workshop in Sao Paulo in February 2008. This discussion is described in chapter 1.6. During this workshop, two Brazilian utilities CEMIG and CPFL reviewed the CDM parameters together with BSH and Proklima. After the workshop, BSH had further bilateral meetings with these utilities but these meetings did not lead to decisions about any of the CDM project design aspects. It is plausible that these utilities did not actively pursue the potential of CDM in low-income communities and, perhaps leaving the lead to Coelba, limited their CDM activities to the generation side of their business consisting of stakes in small-scale hydro schemes and biomass power plants in sugar mills. Nonetheless is it similarly plausible that BSH could have provided the utilities with more precise and more detailed information about CDM. The later was made more difficult because there were several elements of CDM projects about to change, the emission factor, the PoA regulations and the new methodology for refrigerators meant that BSH could only outline different potential CDM outcomes and only indicate a range of economic parameters likely to materialise.

Summing up, it seems likely that Proklima did not use all of the potential to put the impartiality and credibility of GTZ towards Brazilian institutions to full effect. The passiveness with which BSH in Brazil received input from Proklima was felt to be a necessary compromise given the CDM regulations for ODA and the relation between BSH Germany and BSH Brazil. Furthermore, the perception of CDM in the Brazilian utilities remained uncertain in Proklima and BSH Germany and no steps were undertaken to assess the regulatory environment of the utilities or other factors that influence the decision making in utilities. Certainly all inputs provided to BSH Brazil concerned essential aspects of CDM projects and therefore it is rather likely they these affected the capacity in BSH Brazil to act.

1.2.4 Activities to implement the CDM project

The operational side of a CDM project did never start because no Brazilian utility company agreed to implement one with BSH. The successor of BSH, Mabe is still delivering energy efficient refrigerators to many utilities for their efforts in low-income communities as did BSH throughout the PPP. Coelba has submitted two PDDs for the same CDM project and both could not be registered. Mabe, as has BSH, delivers all refrigerators that Coelba replaces. Mabe is in negotiation for CDM with Coelba and with Light, the utility in Rio. Eletropaulo is the only utility to submit a PDD and is expecting to achieve registration.

Result 4 Activities:

- Collection and recycling of old refrigerators
- Installation of new energy efficient refrigerators (number depends on Result 1)
- Monitor CDM operation and submit Monitoring Report via a DOE

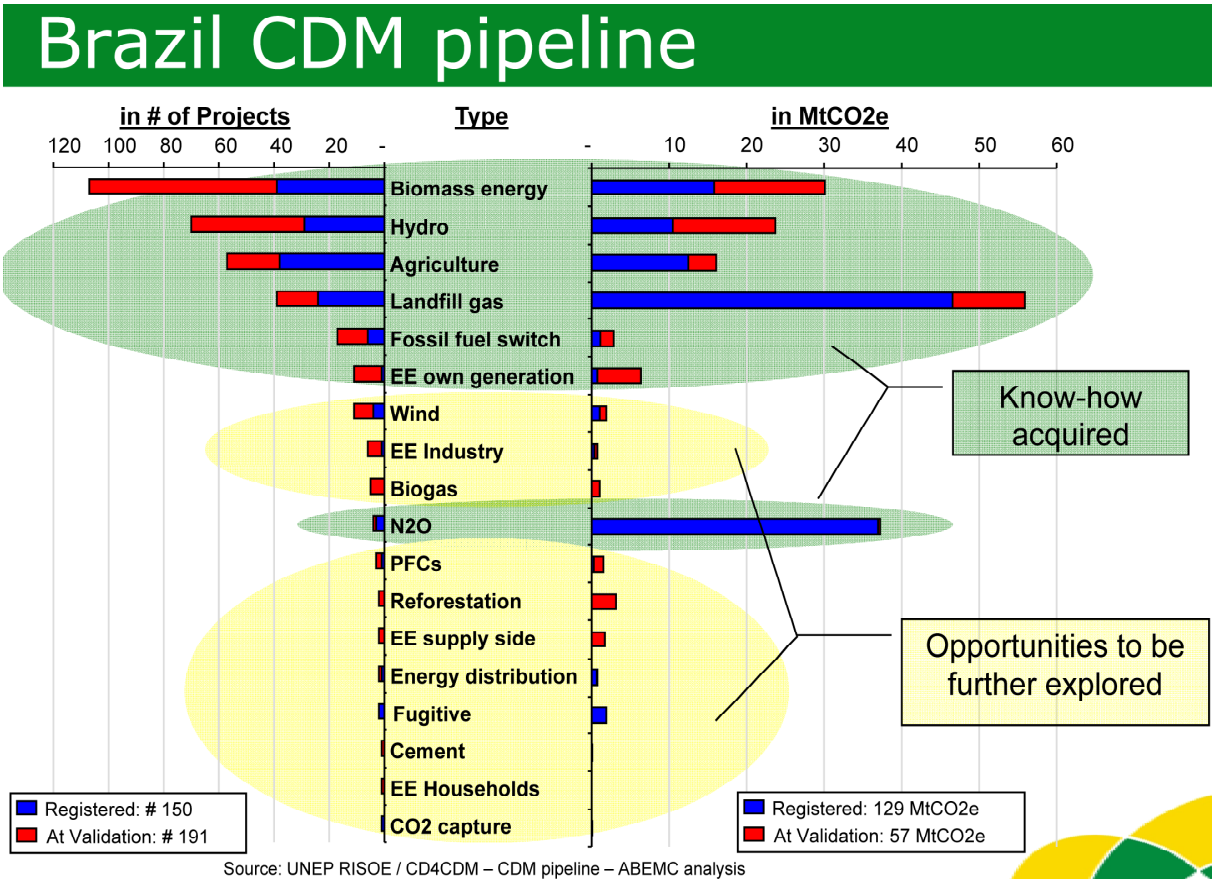
Source: PPP Statusbericht GTZ

The only contribution of BSH for the CDM project implementation that had already occurred was BSH's contractual agreement with a refrigerator recycling company Oxil. This agreement allowed BSH to offer utilities a guarantee to dispose of their collected old refrigerators. BSH also intended to get competitive advantage over its competitors because Oxil was allowed to only recycle refrigerators from BSH. With the withdrawal of BSH from Brazil, Oxil now has established other business alliances. Coelba has started to deliver its old refrigerators to Oxil. The recycling side will change in Brazil when the "BMU Internationale Klimainitative" funded recycling plant starts operation because it will be the first installation able to recover insulation foam blowing agent in Brazil. The planning for this recycling plant was not completed when BSH announced in June 2009 that it would withdraw from Brazil.

It is not insightful to speculate about the effectiveness of CDM project implementation that could have happened. An important qualification to add here is that Eletropaulo chose the methodology AMS III.X instead of the AMS II.C which Coelba still used. If the former succeeds where the latter failed, that could be seen as an additional confirmation that the new methodology was needed. That Eletropaulo copied the PDD which was submitted with AMS III.X for its approval as methodology, could be interpreted that this PDD was apt to permit effective implementation.
Finally one possible indicator for the effectiveness of the PPP activities on CDM implementation is the change in refrigerator production of Whirlpool. The crucial eligibility condition in AMS III.X requires that new refrigerators have foam blowing agents and refrigerants with GWP<15 (copying the criteria from the EU Directive 2002/96/EG of 27. January 2003 Annex II). Whirlpool's production in Brazil still used HCFC-141b as blowing agent (GWP = 725, ODP = 0.11) and changed this to Cyclopentane (GWP = 3.14, ODP = 0) in summer 2009. It is plausible that the eligibility condition in the only available CDM methodology for household refrigerators

was a factor in this change of production because Whirlpool needed to assure that it is able to participate in this segment of the refrigerator market. Like the preceding evidence that Eletropaulo copied the PDD that the PPP activities created, the change in foam blowing agent is also an indicator what the PPP activities for implementation could have achieved had they taken place.

Figure 5



1.2.5 Activities to evaluate the CDM project and disseminate the information

Even without Result 4 activities realised, significant evaluation and dissemination activities took place. It was assumed that the refrigerator replacements by Coelba prior to the PPP would allow a similar assessment of the impact of the replacement on the household level than those under a CDM project. Likewise, the same replacement was used to promote the CDM potential in newspapers, radio and TV.

Result 5 Activities:

- Evaluate project and impact assessment of the refrigerator exchange
- Produce manual for the creation of energy efficiency CDM („Manual: How to do Energy-Efficient CDM)
- Publication of promotional material

Source: PPP Statusbericht GTZ

An impact assessment for the refrigerator replacement at the household level was conducted during July and August 2009 by the company Potencial Pesquisas in Salvador[1]. This company had previously worked for Coelba on assessments of industrial customer satisfaction and has considerable experience in opinion surveys for marketing and political campaigns in Bahia. The first phase of the assessment comprised undirected interviews with 30 households, the second a focus group with households <SM2 and another focus group with >SM4 households. On Coelba's insistence, the "Agente Coelba", the social workers operating the refrigerator replacements, were present during the focus groups. This could not be avoided because Coelba's collaboration was necessary to get access to these households. The following objectives (in Portuguese) were chosen to discover co-benefits of the refrigerator for any other aspect of the household situation in particular for nutrition, women's occupational changes and health impacts:

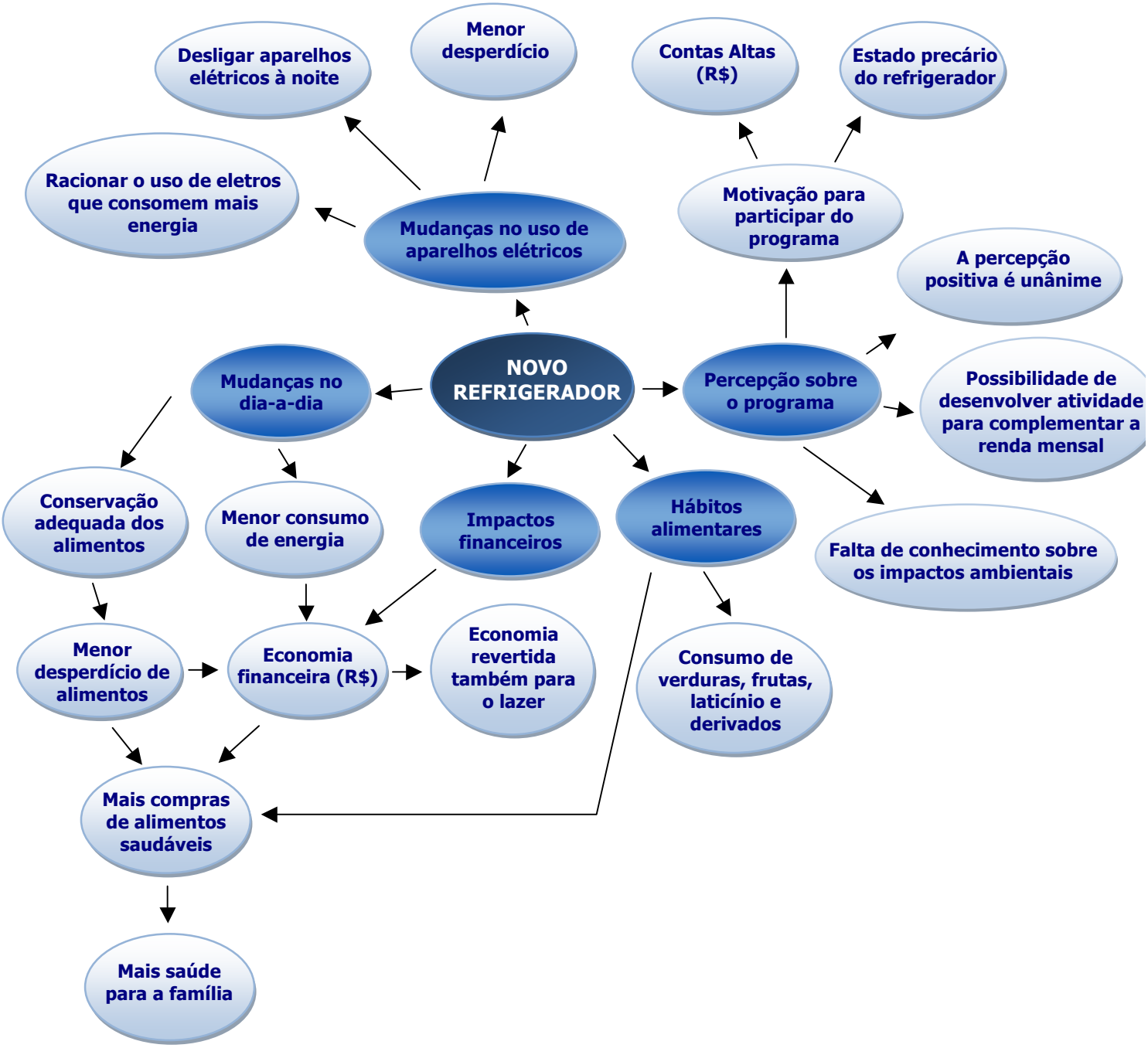
- Identificar as mudanças no dia-a-dia e hábitos da família após a troca do refrigerador;
- Analisar a percepção a respeito do programa e seus impactos financeiros na renda mensal;
- Identificar os itens contidos no refrigerador e hábitos relacionados às refeições da família;
- Identificar mudanças no uso de outros equipamentos domésticos que consomem energia;
- Listar características do antigo refrigerador.

On demand from the Agente Coelba, Potencial first conducted 5 interviews with them, where they stressed the barriers of distrust at the start that remained until households saw the monthly bill reductions after the new refrigerators were installed. Coelba is perceived with suspicion and resistance ("certo medo") towards public agencies in general is strong. Only once households informed each other on the results, did new households appear and the Agente had to turn those away that did not qualify for the refrigerator replacement. Impacts that the Agente stressed were additional consumption of yoghurt, meat, milk and vegetables, and additional energy savings from better usage of other appliances. It should be mentioned that all 115 Agente Coelba active were employees of AVSI, an NGO in Bahia with a strong catholic social policy agenda.

[1] Only one similar assessment has in the past been conducted, for the Kuyasa Pilot CDM Project (ref.0079) in South Africa and similar tools were used in 2003 (no CERs issued to date).

The individual interviews with households (first phase) yielded the following:

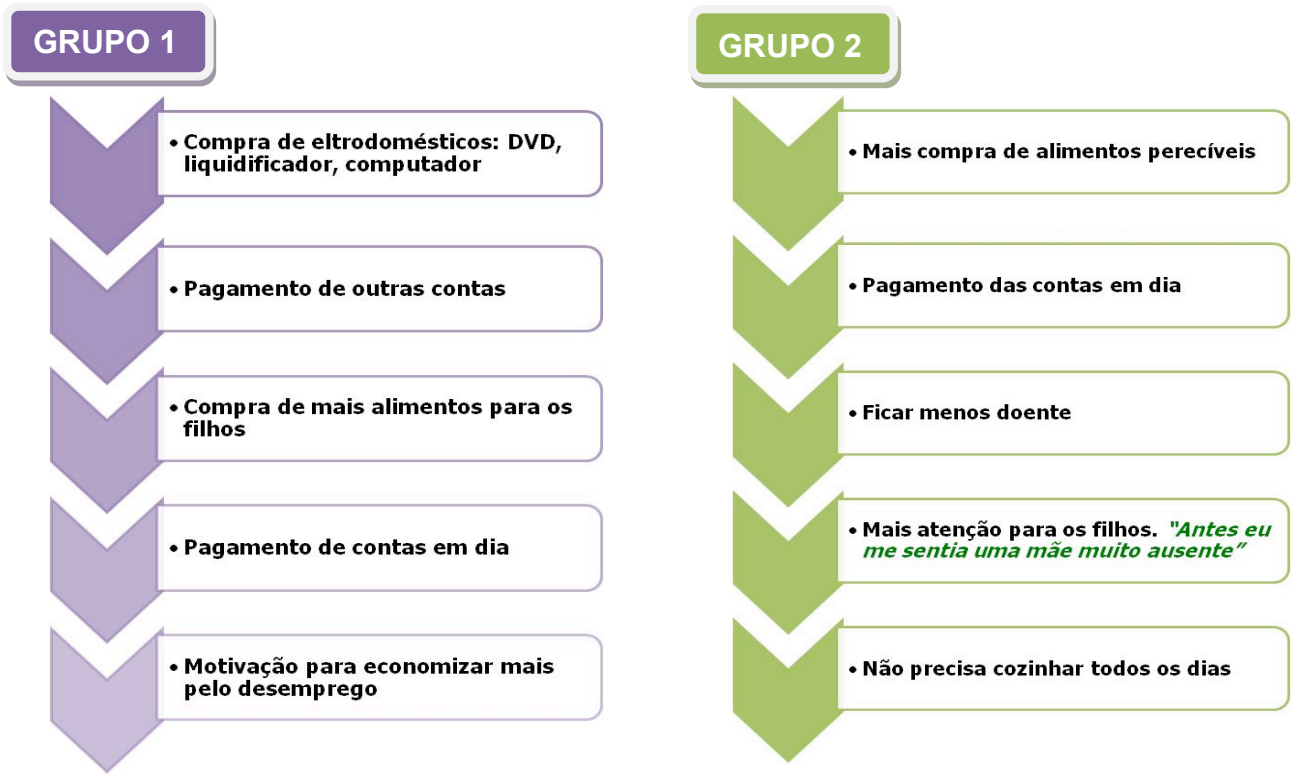
Figure 6



This inventory of impacts on the household reflects the households' subjective perspective. Overall the same impressions appeared over the range of income, from SM1 to SM5, indicating that food purchase changes and the possibility to cook in the house every day, are both similar impacts.

These results of phase 1 were confirmed by the focus groups because the impressions of <SM2 households and >SM4 households were similar, even the reverse of the expected the poorer households stated that they could buy more appliances, whereas the richer ones said they would buy more food:

Figure 7



Phase 2 of this impact assessment must be considered failed. Focus groups are standard tools for Potencial and therefore the presence of the Agente Coelba in the focus groups should be the cause of this failure. Agente Coelba are locally seen as the originators of the gift of the new refrigerator and the focus group participants expressed what they thought Agente Coelba would appreciate. The results of the ESMAP study in the Favela Cajú in Rio, see Table 1 above, indicate that household economics conditions vary significantly between rich and poor households in Favelas and the focus groups organised by Rio university are more reliable.

The impact assessment revealed that co-benefits on nutrition and health are significant and can be of similar magnitude than the direct benefits from the energy efficiency. The fundamental cause for this magnitude seems to be that the large majority of old refrigerators were only used to cool water and perishable food items were not stored in them. Further analysis will be needed to quantify these nutrition changes and define possible health impacts. These impact assessment results are unprecedented and if they are distributed to utility companies might contribute to the expansion of utility assistance in Favelas. The focus groups should have been defined in more detail to assure that Potencial organises them effectively. It is not possible to rely on the experience of a survey company because the Favela level prominence of the actors motivate them to influence the survey work.

No impact assessments of any Favela activity by a Brazilian utility company is published, neither in the social science literature nor in the energy policy literature. There are plausible barriers to this, for example, the ESMAP study suggested that the distribution of LPG in Favelas in Rio, stressed as effective social policy instrument, is in fact in the control of criminal groups. The impact assessment by the PPP could stimulate future innovative studies by utility companies.

The complex and powerful connection of issues ranging from ozone issues, energy efficiency in households, energy efficiency in slums and Favelas, savings for the households to service improvements for utilities is the core of the documentation provided to professional journals, professional conferences, radio and TV. The following list is not complete but gives a good indication of the spread of the information dissemination:

- ZDF Auslandsjournal 9. December 2009, 22:45, Andreas Stamm helping with the refrigerator replacements in several Favela households, as one of several diverse emission reduction examples worldwide and then extrapolating the examples towards the 2ºC goal.

- Deutsche Welle Brasilien 29. October 2009, reporting on the refrigerators replacements and conditions for participation by households.

Print media:

- VDI Nachrichten, 14. November 2008, Nr.46, p.3, outlines Coelba's estimate of the income from CERs through the refrigerator replacement, "Gatos" and increased food purchases.

- Natur + Kosmos, 02/2009, p. 2-7, sketches BSH business model and the additional reward from CDM projects for the most efficient technology, suggests GTZ's role is to maximize environmental benefits.

- Brand eins, 06/09, p. 40-42, calculates a 15% saving of total household expenses, 2.3 mio low-income households in Salvador, a 40-60 Euro contribution from CDM for the refrigerator cost, mentions that BSH is the first manufacturer to submit a CDM methodology for approval.

- Beyond Green, May/June 2009, p. 34-36, states that BSH is first to apply for recognition under CDM as part of a PPP, mentions HFC and CFC, the Brazilian governments announced expansion of the refrigerator exchange, and explains why BSH won the German Sustainability Award for corporate strategy.

- Environment & Poverty Times, 06/2009, p. 16-17, describes the CDM and prints an interview with BSH's Shiroff where he stressed the synergies between GTZ and BSH and the need for compliance market and voluntary market credits combined to cover the cost of recycling.

- Akzente, 03/2009, p. 6-9, explains the achievement of the approval of a new methodology, prints a brief interview with BSH's Shiroff, mentions CEMIG.

- guia Exame, Outubro 2008, p. 48, portrays the refrigerator exchange and Coelba's Luz para Todos, mentions Coelba's parent company Neonergia and its membership of the UN Global Compact.

- Valor económico, 22/01/08

All of these print pieces stressed the “eye-level” message of the low-income situation and reproduced statements from household members. The remaining was factual information about energy efficiency, prices, number of refrigerators and roles of the organisations GTZ, BSH and utilities. Each journalist chose to stress the one of the three organizations of most interest to the particular readers. All journalists took a “this is fact, independent of politics” position and rhetoric. This is undoubtedly useful, however, it is also useful to outline the profound policy dimensions. The operational features do not explain what Favelas are in the political environment of Brazil, the aborted state of privatisation of public utilities, the tendency in German industry to boycott the CDM, or the ideological landscape around emissions trading, to mention a few.

Conference papers:

7° Encontro de Eficiência Energética e Pesquisa e Desenvolvimento, Associação Brasileira de Distribuidores de Energia Elétrica, Praia do Forte, Bahia, Brasil, 24 - 25 September 2007

5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL) 16-18 Juni 2009 Berlin
http://www.eedal.eu/fileadmin/eedal2009/presentations/Cold_Appliances/057_Shiroff_Grammig.pdf

The Future of Sustainable Products & Services 28-29 September 2009, Essen

Atmosphere – International Conference on Natural Refrigerants, 19-20 October 2009, Brussels
http://www.atmosphere2009.com/files/speakers/presentations/pdf/thomas-grammig.pdf

All papers stressed that any manufacturer with the most efficient technology can support its marketing by tapping the carbon markets. The audiences were different, at the ABRADEE meeting all Brazilian utilities attended, at EEDAL participants represented large companies across Europe, Sustainable Products was for designers and industrial policy specialists and the Atmosphere conference brought the refrigeration industry together. The paper for EEDAL was also distributed in print to all participants of the Sustainable Products conference.

Since most of these publications, the TV programme and the CDM methodology AMS III.X are available on the Internet it seemed of little additional value to create a new Website for the PPP. International scientific journals in climate change and in energy have published several excellent pieces from renowned scholars like Prof. Gilberto Jannuzzi and Roberto Schaffer about the importance of household refrigerators. Coelba and BSH have produced promotional videos about the refrigerator replacement and explain CDM in their annual reports. Two aspects important to disseminate were not pursued, first the household impact assessment because it doesn’t bring the impacts together in the focus groups, and second the above average price for Certified Emission Reductions (CERs) that can be achieved because of the co-benefits, since no CDM project was registered. The impact assessment would have been particularly salient because the provision of public services in Favelas is suffering from a certain stigma that keeps utilities from seizing these conditions as business opportunities.

1.3 Expectation formulated by BSH and those evident during the PPP work meetings

Relations between GTZ-Proklima and BSH have a long history, starting with the beginning of the Montreal Protocol in the early 1990s. Those who worked together back then have since retired. The individuals involved in the PPP had professional contact when engaged with other companies before joining BSH and Proklima. Still the CDM is a complex subject matter with much implicit knowledge and assumptions that create misunderstandings even between people with similar educational backgrounds.

Before PPP contract signature

BSH Brazil prepared a CDM project outline for GTZ-Proklima in November 2006. It contained suggestions from commercial CDM developers ATA, Ecoinvest and MGM to use CDM to convert that part of BSH's refrigerator production from HFC-134a remaining to Isobutane, about 40% of the total, and stated that refrigerator replacements done by utilities would not meet the additionality criterion. ATA, Ecoinvest and MGM are among the most successful CDM developer companies in the world. BSH Brazil knew that Coelba had hired ICF to produce a CDM project document. BSH Brazil had learned from their customer Coelba that CDM was a business factor and had started to scan the Brasilian carbon market players for their interest.

The first exploratory meeting was 6. February 2007 between BSH Germany head growth market, two members from GTZ-Proklima and 4 staff of BSH Brazil. GTZ-Proklima rejected the suggestions from the developers and affirmed that refrigerator replacements have much safer additionality grounds. GTZ-Proklima pointed out that BSH could realise a CDM project with existing methodologies, acknowledging the risks in submitting a new one. BSH Germany had already screened methodology specialists in Germany, concluded that GFA was a better source than Perspectives and had decided that BSH would gain most competitive advantage by creating a specially designed methodology despite of the risks involved.

GTZ-Proklima and BSH Germany were surprised to find they shared the judgement that the methodology's baseline can be strengthened by combining energy efficiency and HFC emission reductions, they had similar views on Osram's CDM problems (with CFL lightbulbs) and of course that for the technology leader (highest efficiency) his marketing and the CDM quality objective are fully equivalent. GTZ-Proklima saw its most evident role in the stakeholder consultation, whereas BSH assumed GTZ-Proklima to be a better methodology submitter as a third party.

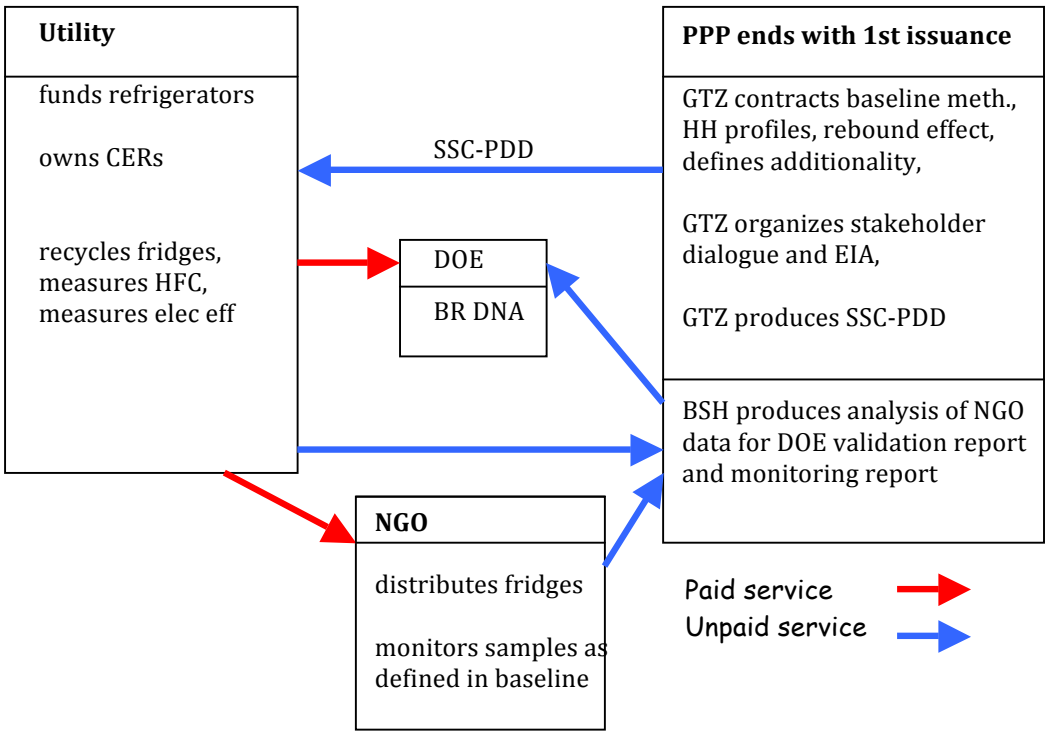
The conclusion of the first exploratory meeting was that a PPP was a high risk venture towards an unpredictable methodology approval process but that there was an agreement on the quality criteria for a methodology. The complementarity between GTZ-Proklima and BSH towards the CDM bodies was evident but it was not clear whether there was also complementarity in skills and capacity.

One month later, 6. March, the sole strategy meeting between BSH and GTZ took place in Munich, 4 GTZ and 6 BSH employees attended. GTZ-Proklima proposed to define the overarching goal as: Maximum CER volume worldwide during the first commitment period.

This goal was seen as a suitable simplification, because it didn't rank technical criteria, operational criteria or target population criteria. Nor did it define whether one or several methodologies and of what type were intended. This goal satisfied BSH business interest and reflected GTZ-Proklima's Montreal Protocol view that global emission volumes are overriding variable. This overarching goal was certainly defined with pragmatism but it was also leaving many strategic details open to be dealt with step by step. This goal also avoided potential obstacles such as GTZ-Proklima's insistence on some developmental focus on socio-economic variables or preference for some carbon market actors. Perhaps BSH would have agreed on them but the uncertainty of such preferences' implications for BSH business development objective was significant and might have prevented an agreement.

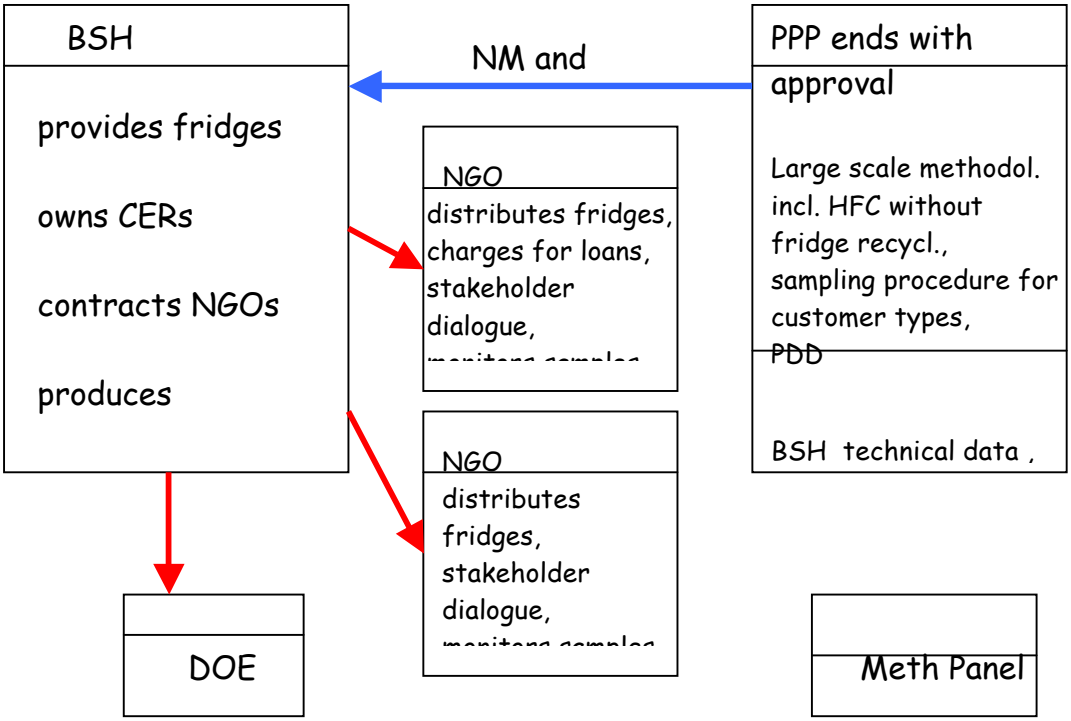
GTZ-Proklima further suggested that a DSM-type CDM was more suitable to develop a small-scale methodology or apply AMS II.C and also needed to establish a PDD quality level. GTZ-Proklima intended to act as a facilitator for utilities who would be CDM project proponents, providing a PDD, stakeholder consultation, leaving the monitoring for BSH. A second model was a self-standing CDM suitable for a large scale methodology, where BSH was CDM project proponent.

Figure 8



Source: GTZ handout for 6. March meeting

Figure 9:



Source: GTZ handout for 6. March meeting

BSH saw first of all a possibility of CDM as leverage for its technology but was not clear what aspect of CDM was crucial for this leverage, transaction costs, baseline issues, monitoring problems, methodologies, recycling, and these diffuse aspects of CDM project validation and registration. The only element of strategy that BSH formulated was to create a business model comprising all necessary elements and the one that might be particularly effective was seen to be the recycling capacity.

Going through these aspects, the meeting only produced a decision that GTZ-Proklima would further refine the CER estimate and BSH measure 5 refrigerators from Favelas. None of the various elements for PDDs and methodologies that GTZ-Proklima described were identified as crucial or discarded. BSH saw a self standing CDM as preferable because it might allow better moulding into a business model.

In sum, there was accordance on the list of issues and variables that shape CDM but there was no common understanding of how they fit together and what takes precedence over other elements.

Soon afterwards, BSH Brazil reacted to the suggestion of a PPP producing the CDM documentation for utilities and they were not sure on what basis this would happen. Coelba had told BSH Brazil they would produce the PDD themselves and would keep the CER for themselves. Coelba also told BSH Brazil the criticism from GTZ-Proklima on the PDD was helpful for them. BSH Brazil wondered why Coelba should wish to involve them when all Coelba was looking for was advice from GTZ-Proklima and why Coelba would “share” CER proceeds ? BSH Brazil did not know what constellation of interests would appear.
In parallel to these discussions, BSH Germany and GTZ-Proklima produced the basis for the PPP, the so-called Statusbericht and Planungsübersicht, that are used

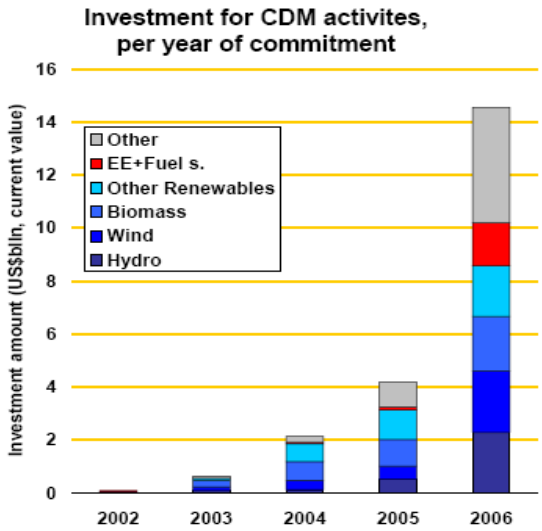
for all GTZ activities. In fact GTZ-Proklima wrote 90% of these documents and BSH and the PPP department in GTZ followed these suggestions passively. There was considerable blind faith in GTZ-Proklima that the tasks being formulated could be effectively addressed.

During this period leading to the signature of the PPP, the Brazilian employee of GTZ-Proklima played an important role. He was well acquainted with BSH Brazil, the Brazilian Ministry of the Environment, Coelba and the GTZ office in Brasilia. His conversations on the telephone in Brazil improved the mutual understanding. He had no experience in CDM and his background in journalism left him clueless in front of any technical argument, but very likely this helped him in this role. Coelba explained to him how they had found out that ICF did not understand the energy efficiency issues to be put in the PDD and he was told that Coelba would translate ICF's PDD into Portuguese to then improve it with Coelba staff. Coelba never revealed so much about their intentions to BSH or to someone else in GTZ-Proklima, only to the Brazilian member of GTZ-Proklima.

Anticipating if Coelba would cooperate with a BSH/GTZ based PPP was a precondition for fixing the intended products of such a PPP. Doing this implied in essence to hear from the Brazilian employee of GTZ-Proklima how Coelba approached its own difficulties with developing a CDM Project and speculating how attractive the GTZ-Proklima CDM competence was to them. Well it turned out that GTZ-Proklima's judgement of Coelba at that time (formulation of PPP) was quite wrong. Luckily Coelba was always helpful to open doors in other utilities for GTZ-Proklima and this allowed to gauge the utilities' interest in CDM.

GTZ and BSH signed the PPP agreement in September 2007, right at the same time Coelba organised a conference of the utility association ABRADEE where GTZ-Proklima made a highly promotional presentation about CDM as a business opportunity for utilities (Figure 10 shows the most important slide).

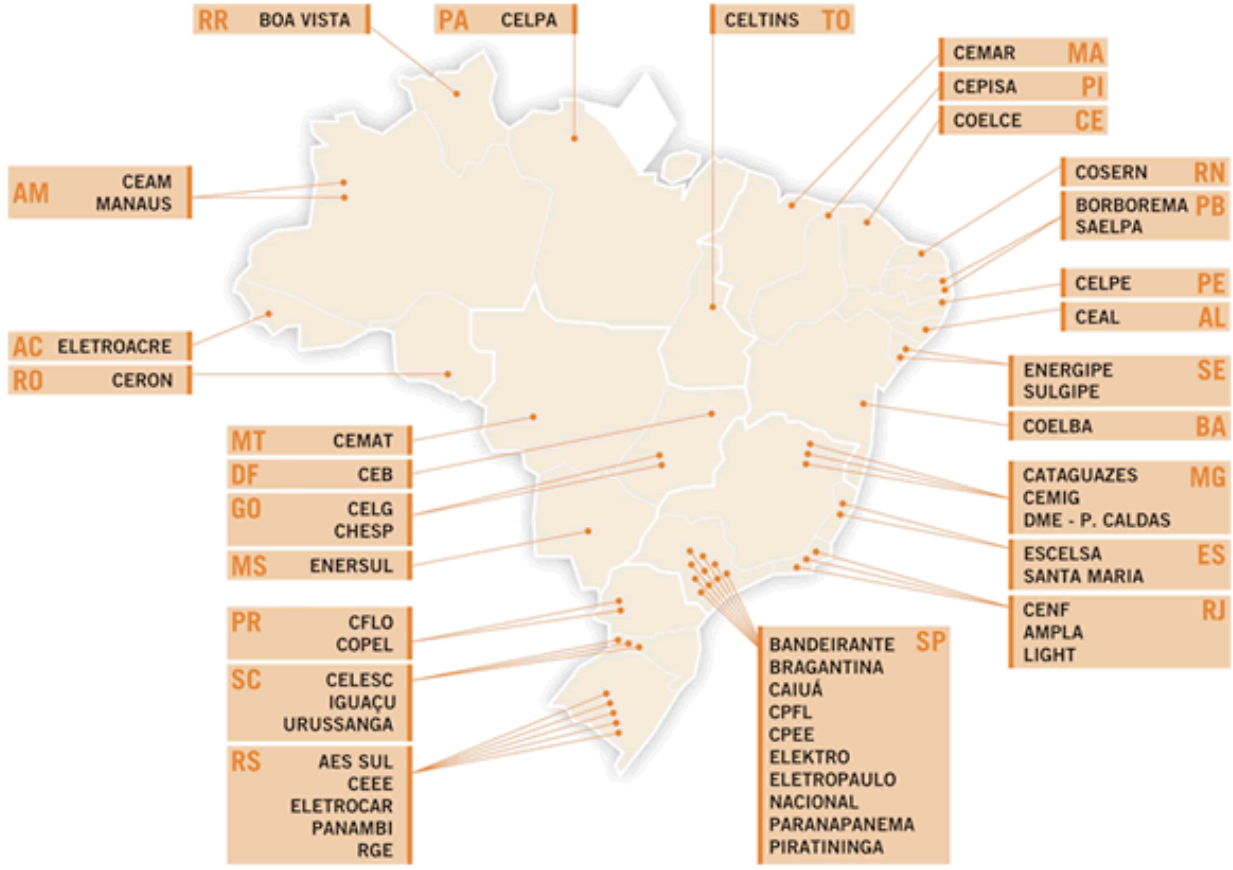
Figure 10



Source: IBRD

Coelba submitted its first PDD to the UNFCCC on 15 June 2007. GTZ-Proklima did not bring its shortcomings up for fear of offending Coelba but prepared a detailed critique and sent this to Coelba. GTZ-Proklima considered itself lucky that Coelba did not disinvite GTZ-Proklima from the ABRADEE conference because of this critique. BSH Brazil and BSH Germany did not react to the PDD's appearance either. GTZ-Proklima felt the opportunity to advertise its open offer of assistance to CDM development in front of all utilities at the conference would most likely change its standing and increase their attention. Stunningly the discussions during the conference were polite, the question rather positive, the reactions encouraging and statements for CDM were made in the plenum, however, absolutely nothing came of it, the utilities remained passive. A possible contribution was that the Brazilian regulatory authority ANEEL was present and did not signal to the utilities how they would judge CDM development efforts. The ABRADEE meeting was a sort of beauty contest for utilities' energy efficiency pilots, CEMIG's "Solar baixa renda", Copel's "mobile education" buses, and so on, presented one after another with the regulator watching passively. The Brazilian utility companies present were:

Figure 11



Source: BSH

A revealing anecdote of the relations when the PPP was signed - when BSH Germany asked a member of BSH Brazil during the conference by Email what their impression of the GTZ-Proklima presentation was, this member didn't know what to say and asked the Brazilian member of GTZ-Proklima to formulate a response that she would send to BSH Germany, which of course he did. The member of BSH Brazil did not tell her Brazilian BSH colleagues that she had done so. Individual tactics in BSH augmented the uncertainties. So both on the stage of the conference and behind the curtains, the doubts about the nature and scope of CDM potential for refrigerator replacement were such that the pecuniary interests did not become the real decision criteria. Instead the assumed and/or the actual differences in capacity let to the PPP contractual agreement.

After the PPP contract signature

In the order of importance, BSH hoped to gain the following from its collaboration with GTZ-Proklima:

- better access to Brazilian utility companies
- intelligence on the CDM approval process in the UNFCCC
- intelligence on the source of CDM document components
- financial help to pay for these sources
- help with defining the baseline and monitoring methods and calculations
- better understanding of the socio-economic aspects that would be acceptable in CDM projects

BSH Brazil started to ask more focused questions to GTZ-Proklima after the contract signature, often with more critical intent than those BSH Brazil asked BSH Germany and more critical than what BSH Germany asked from GTZ-Proklima.

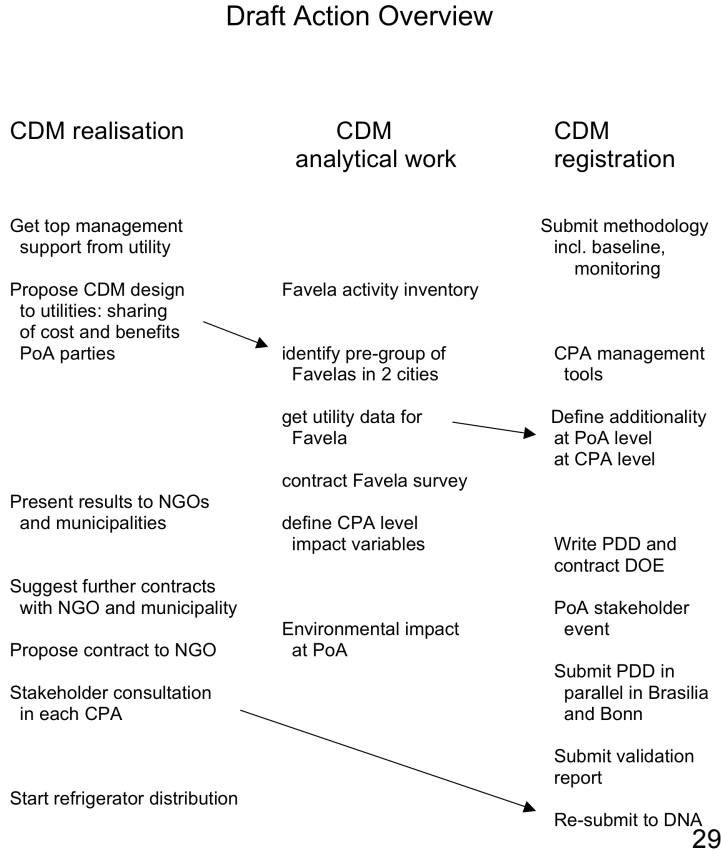
1.4 Inputs from BSH and from GTZ-Proklima during the first phase

With a PPP contract allowing flexibility to explore many different options and a clear overriding goal, the first phase of pursuing the PPP was an extensive scanning of technical, economic and social variables. Demand-side Management (DSM) of any utility, appliance R&D, energy policy and many more fields had to be perused. GTZ-Proklima collected and analysed low-income households statistics and the literature on public policy towards Favelas. More importantly GTZ-Proklima defined what input would be sought from experts, esp. Anne Arquit Niederberger and Thais Corral. Understanding whose expertise was going to bring a contribution to the PPP was a step to prepare design decisions. Qualifying the uncertainty on the emission factor in Brazil, the Brazilian DNA's decisions were deemed to be weak and so it was not possible to use judgement and these decisions were assumed to be unpredictable. BSH went along without questioning this rationale. Design elements to be clarified next were:

- Methodology for refrigerators only or also other appliances
- Inclusion of which gases in a methodology
- Methodology for replacement only of also for retrofitting
- Large or small scale
- Metering instruments and testing protocols
- Test of a monitoring approach for AMS II.C
- Deemed savings quantification
- In situ exchange vs. self-purchase, or rebate scheme
- Inclusion of recycling

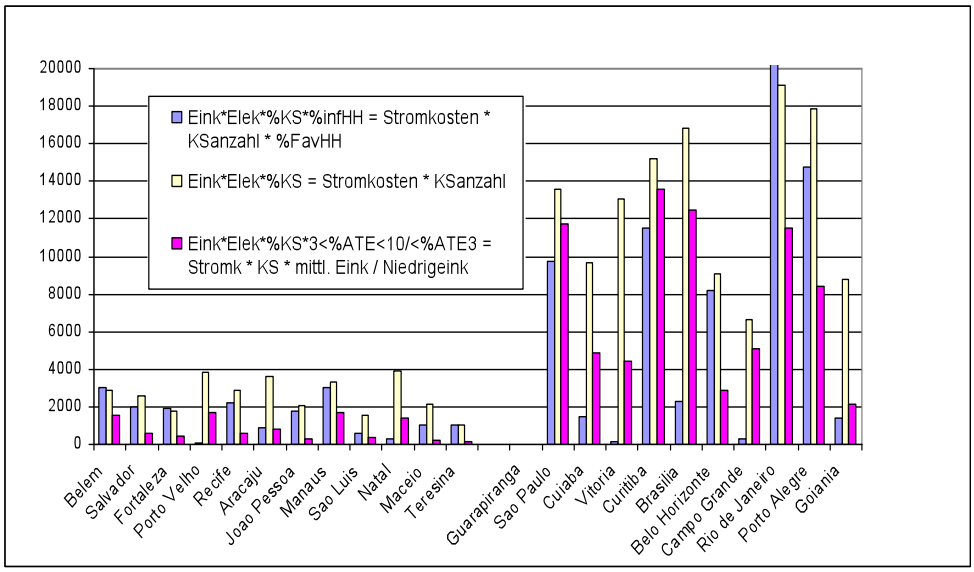
In light of the many open questions a scoping meeting in a large group from GTZ-Proklima and BSH considered the following time sketch that clarified which aspects could be pursued in parallel, although this might force some more loops later. Subsequently this timeline fell apart because it was not possible to include an utility in these considerations. While there was uncertainty about the role of the organisations it was not possible to make predictions when CDM design tasks would became feasible.

Figure 12



Hoping that several utilities might decide to test CDM and offer BSH the opportunity to sell refrigerators against carbon, GTZ-Proklima attempted to define an aggregate indicator for the suitability of a city based on available socio-economic data, Favela size, average income in Favela, income distribution, electricity prices, electricity consumption and appliances in use were used:

Figure 13



Preparing input to an offer from BSH Brazil to a utility was the direct way forward and therefore the overview of partners in Curitiba (see chapter 1.2.3) was started and REDEH contracted. GTZ-Proklima continued to question BSH Brazil on its relations to utilities. BSH Brazil supported a “turn-key” approach but there was initial analysis necessary to create a turn-key offer that BSH Brazil had to understand first. BSH Brazil spent considerable efforts in initial contacts with eleven different utilities in order to improve its understanding but they could not synthesise the information received into a BSH business model for CDM.

Final input from GTZ-Proklima was a testing protocol and metering requirements. ISO 15502 was widely used for new refrigerators, however, this standard was judged to be at the lower end of the possible accuracy range. It ignores usage such as the amount of food entered and the number of door openings. There are six major variants of refrigerator testing standards in use worldwide and efforts to harmonize them have failed repeatedly. Ambient temperature variation and defrosting are the factors creating the most variation between test results and actual efficiency in normal use. As a first assumption, GTZ-Proklima proposed to measure electricity consumption and compressor running time, which together allow for more precision although the difference is often minor. Taken all current CDM regulations produced by the UNFCCC at the time into account, it was not clear what level of accuracy was required and whether there was a trade-off between more accuracy and more emission reduction credits or not.

The energy related carbon emissions of refrigerators can be calculated by the following algorithm:

$E_c = e_i * n_i * El_i * c_i * o_i * d_i * T\&D$

E_c	Annual Carbon Dioxide equivalent emission in a defined region/project [kg CO_2eq/a]
e_i	Emission factor of relevant electricity supply grid in defined region/project [kg CO_2eq/kWh]
n_i	Number of pieces of refrigerators in use (or replaced) in a defined region/project [-]
El_i	Average annual electricity consumption of one typical refrigerator under standard conditions [kWh/a]
c_i	Climate correction factor of annual electricity use of one refrigerator in a defined region/project/climate due to different indoor temperatures [-]
o_i	Average operating correction factor of annual electricity use of one typical refrigerator in a defined region/project/climate due to non continuous operation [-]
d_i	Average stage of deterioration factor of annual electricity use of one refrigerator in a defined region/project/climate due to defects [-]
T&D	Transport & Distribution Losses in relevant supply grid [-]

There was no information available anywhere about testing adequate for old refrigerators in low-income households. A few available measurements from Coelba and from Copel did not provide enough detailed information. Therefore, BSH Brazil needed to start testing old refrigerators and also to start modifying testing procedures to see what level of testing details would lead to significant differences.

1.5 Approach of the Small-scale Working Group and interpretation of the answers to the queries

Four areas of work were pursued in parallel, the testing and monitoring, the business relations and business model possibilities, the analysis of socio-economic data and finally the interpretation of CDM regulations related to or more generally relevant for household refrigerators. To the surprise of all, it was the latter area where progress was quick and decisive.

At the end of 2007, only one methodology for refrigeration technology, so-called AM0060 for the replacement of chillers existed, approved by EB 36 in November 2007. Chillers contain a refrigerant in circulation whose leakage in operation contributes to ozone depletion and to the greenhouse effect (also called “direct emissions”) besides the electricity consumed and the respective fossil fuel consumption in the power plant (“indirect”). The questions about the appropriate boundary are similar to those for refrigerators. It had taken more than a year to

decide AM0060 because the Executive Board doubted to what extent it should take the ozone depletion effect and the regulations in the Montreal Protocol into account. The compromise found for chillers was only energy efficiency gains could be credited and the greenhouse effect contribution from leakage of refrigerant was excluded from the boundary. An eligibility criterion imposed that the GWP of the new refrigerant had to be lower than the previously used one and the difference between old refrigerant GWP and new refrigerant GWP was assumed to increase only the conservativeness. In effect this implies a new chiller can contain a refrigerant with a GWP of zero or one with a GWP of 4,000 and the emission reduction credits are the same in the two cases. There is always a trade-off between accuracy (often bringing optimal incentives for technological improvements) and assuring an under-estimation of emission reductions, so-called conservativeness, so that no operational detail would render a CDM project to costly or difficult. "The perfect becoming the enemy of the good" occurs in many methodologies. This compromise in AM0060 is clearly not such a case and it would have been far better to include refrigerant leakage so that a new chiller with GWP of 4,000 would achieve lower results than one with GWP of zero.

In fact the World Bank's Carbon Finance Unit argued intensely with the UNFCCC's Methodology Panel to include the refrigerant in the baseline, but found it impossible to get the technological factors in the chiller equipment market acknowledged. It took three meetings of the UNFCCC's Executive Board (EB34 – EB36) to reach this compromise. The argument as laid out to the EB is on:

http://unfccc.int/resource/webcast/cdm/eb34/downl/Annex%20A%20gases.pdf

GTZ-Proklima consulted with the Carbon Finance Unit and concluded there was scope to improve this weak compromise if the rationale is approached in a more constructive manner.

The questions about energy efficiency and direct emissions from refrigerants are "sticky" because the Montreal Protocol and the Kyoto Protocol overlap there. This overlap is a confuse policy area. Already for AM0001 back in 2003, this overlap added to the controversy for HFC-23 abatement projects and it is still unresolved until today. Household refrigerators have absolutely nothing to do with HFC-23, but given the ferociousness of the controversy, the PPP anticipated for HFC-134a, the simple fact of the same letters of the alphabet "HFC" for the two chemicals, would be enough to ring all sorts of alarm bells in the UNFCCC.

Besides the Kyoto/Montreal overlap controversy, an internal Montreal Protocol controversy is equally sticky and unresolved. The Montreal Protocol favoured a class of substitutes with no or little ozone depletion, the HFCs and HCFCs, however with significant greenhouse effects. These substitutes have helped to replace the "ozone killers" CFC-11 and CFC-12 quickly but it is disputed whether these substitutes were necessary and many doubts remain if the Montreal Protocol was abused by those who provided the HFC and HCFC technologies.

During the scoping meeting, these boundary questions were clarified in light of BSH's position in Brazil because it was the only manufacturer that had replaced the refrigerant HFC-134a with the refrigerant Isobutane. In addition to the refrigerant, a similar question of efficiency and related direct emissions particularly important for

refrigerators is the foam blowing agent in the insulation foam. Old refrigerators have two CFCs in them that were no longer used anywhere for new refrigerators. CFC-12 is used as refrigerant and CFC-11 was the blowing agent that remains in the insulation foam. BSH was also the only manufacturer that had already switched to Cyclopentane as foam blowing agent. Other manufacturers still use HCFC-141b currently.

Table 3

		Prior to Montreal Protocol	Supported by Montreal Protocol	Best available solution
Refrigerant		CFC – 12	HFC-134a	Isobutane
	GWP	10,900	1,430	4
	ODP	1	0	0
Insulation foam blowing agent		CFC – 11	HCFC-141b	Cyclopentane
	GWP	4,750	725	3.14
	ODP	1	0.11	0

A particularly unfortunate part of the two above described controversies has been purposely created confusion about energy efficiency differences of appliances using these substances. Fact is all of these substances allow to produce any level of energy efficiency. A highly efficient Isobutane refrigerator is not different or more costly than a highly efficient HFC-134a refrigerator, and so on. And a low efficiency Isobutane refrigerator is not different or cheaper than a low efficiency HFC-134a refrigerator. Small differences in thermodynamic properties of these substances are more than compensated by engineering details in appliances and all other refrigeration equipment as well.

It was all the more imperative for the PPP to contribute to a “level – playing field”, and integrate energy efficiency and direct emissions as much as possible in the baseline of a new methodology. The highest environmental integrity of a methodology often implies high monitoring costs, but first one can start there and then see how the cost can be brought down. Creating a “level – playing field” was worthwhile from a policy perspective and furthermore it was likely to be easier since it would avoid devising odd eligibility criteria to reflect that refrigerant and energy efficiency have no correlation.

The first step was verifying what gases the UNFCCC bodies were willing to consider. GTZ-Proklima submitted a “Request for Clarification” on 21 December 2007, registered as SSC_152, as a careful verification of basic rules:

> It is the understanding of the stakeholder making the submission that all greenhouse gases in Article 1 of the Convention but not included in Annex A of the Kyoto Protocol should be included in the project boundary (as stated in the EB decision) and, hence, in the baseline and in the calculation of emission reductions, when applying AMS II.C. A confirmation from the SSC WG is requested in this regard.

Since the chiller case compromise had been to account for refrigerant leakage only when emissions increase, the question was whether for household refrigerators with AMS II.C this could be extended respectively to an emissions decrease. This request was formulated by Anne Arquit Niederberger, whose experience in negotiating the CDM as a diplomat was very effective.

To the delight of everyone, the SSC Working Group responded with a "fast-track response" on 23 January 2008, indicating the question was considered relevant and a readiness to deal with it. The content was however not a surprise and the chiller compromise defended:

- Consistent with the decision of EB 34 (paragraph 17), the leakage/project emissions of all greenhouse gases, those included in Annex A of the Kyoto Protocol (KP) as well as those defined in paragraph 1 of the Convention, should be accounted for, if the CDM project activity results in an increase in emissions of those gases. For that purpose all the greenhouse gases, defined in Annex A of KP as well as paragraph 1 of the Convention, should be included in the boundary of the project activity. Therefore if a proposed CDM project activity is likely to result in leakage/project emissions of fluorinated gases (e.g. CFC refrigerants), those gases shall be included in the boundary and the leakage/project emissions shall be deducted from the emission reductions from the project activity.

- Consistent with paragraph 44 of the Modalities and Procedures for the CDM that states that "a baseline shall cover emissions from all gases, sectors and source categories listed in Annex A within the project boundary", only gases listed in Annex A of KP shall be included in baseline emission calculations. CFC and HCFC gases are not included in Annex A of KP, and hence shall not be considered for baseline calculations.

Source:
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_5J8MRHBVKP0M0KDJTTM9NNEGVIBRYD

CFC and HCFC could not be included in the baseline although this is a literally correct interpretation but not a logically consistent one. At this point the PPP had a choice between trying to confront the chiller compromise and this would have meant bringing it up to the level of the Conference of Parties, or to accept it and try to find a solution where this chiller compromise was extended in the best possible form to household refrigerators. All felt that the latter was inferior (luckily to turned out not to be inferior) but there was little chance that the chiller compromise could be overcome at the Conference of Parties, irrespective of the merit it was just not likely on pragmatic grounds. A somewhat defensive choice is often resented because the doubt remains that the judgement is not just pragmatic.

If CFC and HCFC were excluded then another way might be found that a methodology creates some incentive in the right direction. Irrespectively, the HFC chemicals class would be accountable although it was not certain how the energy efficiency plus HFC emissions combination would be considered.

GTZ-Proklima submitted a second Request on 10 March 2008, as SSC_168, more suggestive than the first one and more risky because it involved a lot of other information not contained in the Request and not linked to unambiguous scientific publication either:

- AMS II.C is intended for refrigerators and the two emission reduction components - HFC recovery and energy efficiency, occur in the same activity, i.e. refrigerator replacement. Would it be possible to submit a new SSC category for household refrigerators that would include emission reductions from both energy efficiency and HFC recovery (energy efficiency would be Type II and HFCs would be Type III, similar to other methods that contain a mix of types, energy efficiency and methane for instance)?

If the answers to both the bullets are "no", the stakeholders are of the opinion that it will be impossible to implement the proposed project activity as a SSC PoA, since only one methodology can be applied to each PoA. The stakeholders also estimate that the PoA is financially marginal without credit for the legitimate HFC emission reductions.

Again the SSC Working Group answered with a "fast-track response" on 9 April, and again to much delight with a strong encouragement to pursue the matter:

However, the SSC WG recognizes that it may be necessary, among others, in the refrigeration and air conditioning sector, to include more than one eligible component activities under a SSC CDM project activity or SSC CDM program activities (CPA) under a PoA, for a viable project or a PoA.

The SSC WG encourages the project proponent to submit a new SSC methodology[1] for household refrigerators that would include emission reductions from both energy efficiency and avoided HFC emissions under the same methodology.

Source:
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_NY59PUZXTXL7XORH6SVFM7OX2Q21IC

A few days after that response, during the SSC 15 meeting, the chiller compromise was written into paragraphs 2 and 3 of AMS II.C. This change was finally approved as AMS II.C vs.10 by EB 41 in August 2008. The fast response about HFC and the entering of the compromise in AMS II.C on its own initiative (without any CDM project on refrigeration submitted so this was "unprovoked") showed that the SSC Working Group was actively seeking to make energy efficiency more feasible. This was an expression of the widespread and increasing concern that current CDM methodologies did not allow bringing carbon finance into households. This concern was the reason that "SSC WG recognizes that it may be necessary". The PPP interpreted this to really mean most likely it is necessary to bring HFC and efficiency together and the SSC WG to be support of such an attempt.

AM0060 was dealt with in the Methodology Panel. The Small-scale Working Group does not always follow what happens there. The SSC WG could have decided to consider the arguments for the chiller case presented to EB34 and draw different conclusions about the relations between refrigerant emissions and efficiency gains. Possibly the reason for the SSC WG to modify AMS II.C so quickly was mainly to remove the uncertainty and signal to everybody that they wanted to extend this conclusion to other appliances. And the encouragement of the SSC WG was that while they copied the clause from the chiller case, they wanted to explore possibilities to go beyond it, leaving the GWP condition for new refrigerants as it was. It would have been possible to quantify the necessity to "include more than one eligible component activity" but the problem for the SSC WG was most likely the same as for

the PPP work, little information on old refrigerators in low-income households and similarly for new refrigerators in such households was available.

The two Requests from the PPP had been carefully phrased and a new methodology was not mentioned in them, instead only AMS II.C was referred to. By asking the right questions the SSC WG then suggested something that the PPP had intended to pursue. Afterwards when submitting one, the PPP could always state "we just follow your views". These were not rhetorical tricks, but they show how underlying environmental and engineering reasons work their way into different lines of thought and policy rationale. It is useful and effective to bring this out, in this case that the SSC WG had reasons proper for its perspective as a regulator and not for the views of the CDM project proponents.

Illustrating the controversial character and efforts to contest them, one year after the approval of AMS III.X, a new "Request" for this appeared, SSC_362, and was discussed during SSC 23 in October 2009. The relation between CFC and HFC emissions are queried in a manner to avoid the stringent connection between refrigerant and efficiency gains:

http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_ENVDKE7JFHB72AMGFXUIENCSJ1ZE6G

The company asking Request SSC_362 is the same company that sold Coelba its first and failed PDD for Coelba's refrigerator replacement programme in 2007. This company has also been vocal in the two controversies Kyoto/Montreal overlap and the internal Montreal Protocol controversy. The response from SSC 23 on the Request SSC_362 was when there are old refrigerators with CFC and HFC, then the methodology has to be applied, in other words, the SSC WG seeks to uphold the eligibility criteria in AMS III.X. The intent of the Request SSC_362 was to get an approval to apply the favourable monitoring (of AMS III.X) and avoid the costly monitoring under AMS II.C. This is also an indication that the interpretation of the responses to the two GTZ-Proklima Requests led in the right direction.

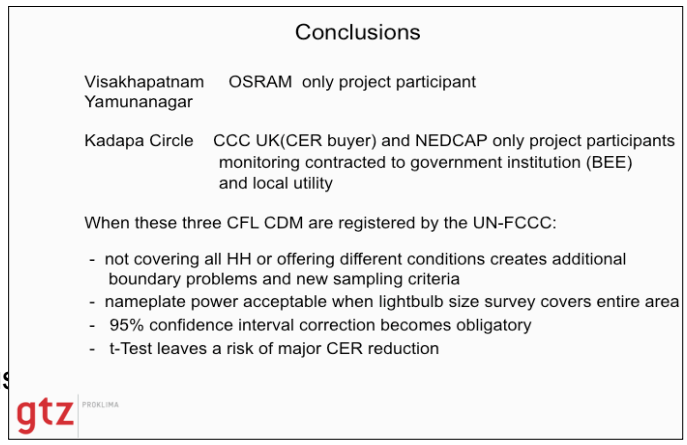
1.6 Intermediate situation after the meeting with BSH, CPFL and CEMIG in Sao Paulo in February 2008

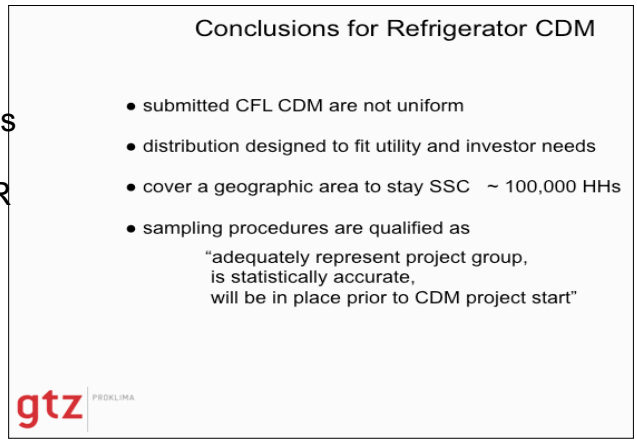
Following the scoping meeting many details about meters, market data, refrigerator specifications, household level data and Favela information was gathered but progress was slow because basic CDM design decisions remained uncertain. What kind of offer BSH could make to a utility, what parameters were attractive to utilities, the operational division of tasks, all the inputs that the PPP needed from BSH Brazil could not be defined. Therefore, a meeting with Brazilian utilities and with BSH Brazil staff to go through all details was hoped to bring design decisions closer.

Ideally as many utilities as possible should attend it and all other bodies that could influence CDM project development be consulted with the same BSH Brazil staff present. This meeting could serve as a "round table" improving transparency among all involved. BSH Brazil managed to bring two of the largest and most influential utilities together, CPFL and CEMIG. Unfortunately Copel declined to attend, probably because a decision to consider CDM could not be taken, and so the results of the study on NGOs in Curitiba by REDEH (chapter 1.2.3) could not be discussed. A member of the Brazilian DNA agreed to participate and such proactive support from the governmental regulatory body was of course a significant opportunity. Finally the most competent academic for utility reform and DSM in Brazil Prof. Gilberto Jannuzzi also accepted the invitation. Together this was a rather select type of "round table" but possibly this small round might turn out to be effective. To address one unclear aspect a micro-finance specialist was also invited to evaluate the rebate type possibilities. To BSH Brazil this meeting was an unique opportunity to demonstrate their competence to the utilities but also to BSH Germany. Elaborate hospitality and sufficient time was needed and a three days schedule was meant to allow careful and thorough consideration of all strategic details including discussions in the refrigerator production plant to review technical and engineering details.

It turned out that the insights gained were not only towards the local context, the other actors and organisations, but also internally. Standing around the refrigerator manufacturing line and shuffling the measurement instruments in the testing facility together with everybody watching, listening and questioning was productive. The need for such hands on reviewing also reflected that different types of expertise had to be combined, the engineers needed to understand the policy problems, but also the regulators had to follow what the technicians could do, the economists follow through the technical factors that created costs and the environmental aspects translated into these other types of variables.

In the last months of 2007, the first CFL CDM projects were submitted by Osram and these might have set a precedent for similar CDM projects to follow. These slides were used to present the CFL CDM so that BSH and the utilities could assess whether these CDM reflected some aspect of their own preferences. CFL CDMs reflected investor needs and adjus





project sizes and households to these needs also so that DOEs would assess them and produce the annual monitoring reports. CER buyers seem to seek control of issuance.

The conclusions from the 3 days are listed in Figure 14. The core conclusion was that the Brazilian DNA as much as the utilities would consider the PPP's products as a package, it was not possible to get them to sign up to a CDM undertaking and build their concerns into the package. Rather the PPP had to assemble as much as it could and wait for the first utility to agree to implement it as such. Part of this conclusion was recognising that the utilities were not going to consider it worth while to improve the economic details, how much it

Figure 14

SUMMARY of WRAP-UP MEETING
Sao Paulo, 28 February 2008

Decisions
- Pursue both PoA models in parallel
  - utility DSM model definitely financially feasible
  - manufacturer buy-back (or rebate) model unsure for Brazil, but certainly feasible in other countries
- All communication w/BSH via Sam for now
- Project will seek Gold Standard certification

Action Points

Shared
- Revised PoA/CPA (aan → ss → Branca Americano/Miguez)
- Questionnaire customer survey (ss draft → cub for input) in all 4 regions
- Initial stakeholder consultation May/June (ss to prepare contract with Avena; dialog tg/ss)
- Clarify VER issue: estimated number of VERs (tg/ju); BSH to clarify whether Oxil can deliver refrigerant data by substance (mv already provided total refrigerant data); buyer interest (aan to identify several buyers w/potential interest in two models to put in touch with ss, who will then require NDA to provide PoA); feasibility of methodology development for VCS or other standard (aan/ju to discuss with VCS, Ecosecurities, CCX, etc); methodology development, if necessary (tg/ju)

GTZ Team Lead
- Query on HFCs (aan/tg)
- Additionality justification according to Additionality Tool (aan → gj)
- aan to recommend qualified international law firms → ss
- EF update (tg to track government decision on sub-grid designation)
- Meter (tg to discuss with BSH-PK Eduardo Piton)

BSH Team Lead
- Conduct customer survey in 4 regions
- Confirm what high-efficiency 2-door model will be offered under the program
- Additional retail cost of two refrigerator models
- Electricity cost / tariff structure (icr)
- Geographical boundary of initial CPA (to be decided by ss after sub-grid definition/calculation of EF by Brazilian government)
- Sales channels and consumer credit arrangements for manufacturer rebate model (ss/eg)
- Old fridge testing (reporting protocol dt draft → cub; monthly reporting dt → icr/ss; clarify if utility delivering old fridges can be determined icr)
- CER ownership issue: clarify if this is an issue under a utility give-away model; contract lawyer to draft waiver for manufacturer rebate model (and utility model, if necessary)
- 0.5% utility DSM investment – restriction on CER generation? Legal analysis (icr)
- BSH strategy to follow-up with utilities on next steps to pursue utility DSM model (after feasibility study May, BSH road show for utilities (individually) with concrete business models)
- Strategy to implement WEEE standard (ss), including ensuring availability of adequate recycling facility at Oxil or other de-manufacturing company

would cost them and how much income they could get from CERs was of too little concern to them to spend their time working on CDM details. Their "accounting habits" were rigid and CDM related to their current concerns.

Another recognition came from the discussion with Prof. Jannuzzi and the Brazilian DNA as it became clear that utilities never looked at their spending of the 0.5% of turnover *wirecharge*[2]. It was evident to the DNA that utilities had no incentive to spend the wirecharge based on its impact on their profitability and therefore under the national utility regulatory regime in place, refrigerator replacement was additional according to the UNFCCC regulation in vigour. The Brazilian regulator that monitored the wirecharge (ANEEL) would always admit that they did not expect the utilities to ever treat if for something else than a "haircut", a flat charge on their income. The Brazilian DNA was thus right to acknowledge "carbon is carbon", what happens to the other parts of wirecharge spending would not be considered. In order to express this clearly and in CDM language, Prof. Jannuzzi was willing to produce a synthesis on his research on the details of Brazilian utility regulation and this would be an unassailable basis to show that refrigerator replacements are additional based on a regulatory barrier, on top of the efficiency barrier and the accounting barrier in utilities.

The Brazilian DNA was at that time studying possible regulations for Programme of Activities (PoA) in Brazil and had not yet decided whether this could direct the initial PoA CDM in a policy relevant direction. When various PoA geographies were discussed for refrigerator replacements, the DNA revealed that it would be in favour of different and competing geographies, for example a refrigerator replacement PoA of one managing entity overlapping with another PoA of another managing entity was seen as positive outcome. In other words, the DNA felt that there can be competition in implementation and it would allow for PoA design differences to play out (also the de-bundling rule was not considered relevant). This implied for the PPP it could pursue its preferences and assume the Brazilian DNA would not object to a particular shape. In particular BSH could pursue a Brazil-wide PoA so that it could offer minimal transaction costs to utilities. A few days earlier, the first PoA CDM worldwide was published on the UNFCCC website, on methane emissions from manure by Sadia in Brazil (registered in October 2009, ref. 2767). The Brazilian DNA confirmed during the meeting that it had seen the PoA from Sadia and had studied it informally. An unavoidable temptation, so BSH Brazil immediately asked if it could submit a refrigerator replacement PoA CDM also informally. To be then told to do so before 5 March, the next internal DNA meeting. The PoA-DD and CPA-DD was sent 3 March to the DNA (formulated for CPFL, Sao Paulo, and using AMS II.C). It might have been better to prepare it more thoroughly as it certainly was not going to be scrutinized in two days, but any CDM project proponent would want to be seen to do its utmost to be helpful to a DNA. The DNA never reacted to this informal version of a refrigerator PoA.

Four people from the utilities CPFL and CEMIG together met the BSH Brazil, BSH Germany and GTZ-Proklima group the following day. GTZ-Proklima summarized the information from the Brazilian DNA and used the worldwide CDM trends (such as Figure 10 from the ABRADEE conference) to illustrate to the utilities that the large DSM potential in Brazil would receive a major boost through carbon markets. CPFL

[2] See case study 9 in World Bank 2008 *Financing Energy Efficiency,* p.235-242.

and CEMIG explained that they were at the stage of establishing utility wide carbon balances, so a stage before considering any operational measures. Reviewing the basic economic factors for a CDM project on household refrigerator replacements created only a promise from the utilities to circulate this internally. CEMIG and CPFL received this input together, which might have increased their attention to it. BSH Germany underlined its interest to implement CDM projects in exchange for the issued CERs but the utilities could not react to that offer. BSH Germany could not use this occasion to discover the utilities' commercial interests. CPFL had in the past paid fines to ANEEL for not spending the wirecharge rather than making the effort to use these funds. This proved what Prof. Jannuzzi and the DNA had said the day before.

So on the financial side this meeting brought no new information. Coelba was the pioneer utility and all others were far behind. For the CDM format, since utilities were at the very beginning, there was no reason for using a standard CDM first to avoid the additional complexity of a PoA CDM. Since BSH Brazil had to explain all aspects entirely, it could start directly with PoA and never mention the simpler aspects of standard CDM. Since the DNA had not expressed any reservation about the merit of PoA, this choice was unlikely to cause additional hurdles with the DNA.

With the SSC WG's answer to the Request SSC_152, that CFC and HCFC were not eligible under CDM, the remaining source of carbon funds for recycling was to develop the recycling as a voluntary carbon market undertaking. BSH Brazil had learnt that many of the utilities had simply stocked those old refrigerators they had replaced in smaller pilots and the only Brazilian company to demanufacture them was charging rather high prices to the utilities. BSH Germany judged that the recycling could be an attractive part of a package offer to utilities. The only Brazilian demanufacturer would not be able to muster the investment to recover CFC and HCFC from the insulation foam but BSH could enable him and this would combine well with the CDM project development offer. A Brazil-wide PoA and a unique demanufacturing site combine well and might convince utilities. However, this solution was far from certain since operational preferences from utilities might not allow inclusion in a rigid PoA frame and demanufacturing voluntary market methodologies were unpredictable. The BSH CDM business model was far from completed but after the February 2008 meeting a working hypothesis was established.

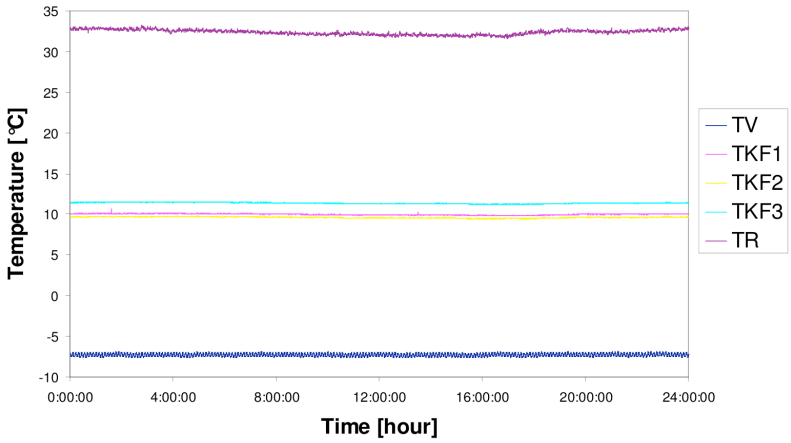
The conclusions about PoA as a feasible format in Brazil also influenced the potential new methodology because at that time only one methodology was allowed to be used in a PoA CDM. Later this rule was changed and several methodologies can be applied in a PoA CDM. The quality of a new methodology depended on the monitoring, what data was needed for the emission reduction calculation, and whether demanufacturing could be build as a condition into the methodology although CFC and HCFC were out of the emission reduction calculation.

1.7 Production of the methodology during May to June 2008

BSH Brazil finally delivered the testing results for the sample of 100 refrigerators from Favelas in mid May. With the SSC WG answer to Request SSC_168, all information was complete to finalize the methodology. The direct effort to produce it took six weeks and it was submitted to the SSC WG 2nd July, and appeared on the UNFCCC on the SSC Methodology Progress Table as NM012 on 17th July.

The main testing results from BSH Brazil were the graphics such as Figure 3, the statistical significance of the sample, but equally important was that a simple testing protocol was sufficient to assure clear results, the temperature curves of all 100 refrigerators looked like the following:

Figure 15



First, it was felt that this sound baseline with easy 24h test results should be part of the methodology so that it would have to be followed always. Luckily the engineering attitude disappeared and instead the obligation any testing protocol follows EN ISO 15502 proposed. The protocol that BSH Brazil had shown to create reliable results was only included in the PDD to NM012, thereby leaving it as a suggestion:

Figure 16

Test of Electricity Use

The internal refrigerator temperature (main volume) should be kept within ± 5 K of the nominal refrigerator temperature. The average refrigerator temperature in 24 hours should be 5° C ±1 K. The internal temperature of the freezer volume should be kept within ± 5 K of the nominal freezer temperature. In all cases, the thermometer should be accurate to ± 0.1 K.

In order to achieve a stable and reproducible test result, the test should be run in two phases:

- Start phase (2 hours)
  - Check of functionality (compressor starts, cooling works), internal temperature depending on thermostat setting.
  - Goal for normal volume: to reach 5°C internal temperature (if not possible: set thermostat to max.).
  - Goal for freezer volume: to reach -6°C (internal * compartment or when has no

indication about number of stars), to reach -12°C (internal ** compartment) and -18°C for separate *** freezer compartment) internal temperature (if not possible: set thermostat to max.).

- Run phase (24 hours)
  - Measure and record electronically:
  - Power consumption (Wh),
  - Average and max/min voltage (V),
  - TKFM= Average internal temperature of main volume (°C),
  - TKFx= Average and max/min of each thermocouple of main volume (°C),
  - TV= Average and max/min of each thermocouple of freezer comp. (° C),
  - TR= Average and max/min room ambient temperature (° C),
  - Run time of compressor (h).

Data Archiving and Reporting

The testing results shall be archived electronically for a minimum of 2 years. Descriptive reports of the results shall including the following data for each refrigerator tested:

- Date and time of test
- Name of responsible testing person
- Description of refrigerator like “Brand Name and Model” , “Production Date”, “Storage Volume”, “Fluid”, “Compressor Model”, “Voltage and Frequency”, “Current” and “Appliance Type”.
- Test results including “Number of Compressor Cycles in 24h”, “Total Compressor Run Time per 24h”, “Number of Defrost Cycles in 24h”, “Period Test Evaluation”, measurements of 5 temperatures (°C) and power (W) (minimum, medium and maximum values), monthly and annual power consumptions, product pictures and some observations about the appliance tested.

Although this testing protocol was likely to be workable in all countries, even a small chance that it might have to be adapted is a reason for allowing it. Referring only to the standard makes understanding EN ISO 15502 necessary for anyone applying the methodology but this was a minor negative aspect.

The average energy efficiency gain between 871kWh old refrigerators to 180 kWh for the new ones, thus 79.3 %, was higher than expected (GTZ-Proklima had predicted 67% at the start of the PPP).

The third important result from the BSH Brazil tests was the non-correlation of electricity consumption with refrigerator age, see in Figure 4. In fact this reflects that maintenance can be of high or of low quality and the differences are statistically insignificant, plausibly because of the wide and well established network of informal sector workshop in all Brazilian cities and low-income communities selling maintenance services to clients that cannot distinguish good service from poor one. It was felt to be a certain risk to include this non-correlation as such in the methodology since it could be interpreted as unrealistic and lead the SSC WG to require more refined monitoring to assure the accuracy of this assumption. To limit this risk, an Autonomous Improvement Factor (AIF) was included that should be modified if testing revealed a correlation between age and efficiency. This precaution proved to be exaggerated.

The absence of correlation between age and efficiency also added another opportunity, it is easier to define a household class participating in the CDM as those that never buy a new one and treat it as homogeneous. While this is socio-economically certainly not accurate, if it allows a sufficiently accurate baseline, then it is viable in a methodology and can reduce monitoring costs.

Another major concern was suppressed demand. The only available information was from Coelba whose data in Salvador indicated that on average household refrigerators were switched off 10 nights per months. Should this be reflected in the methodology ? A feasible inclusion in the monitoring was developed, to select samples reflecting different electricity bills from utility records and then measure suppressed demand in the highest and lowest bill class and assume it to be linear across all households. Assumptions like this one are simplifications that can augment obstacles in methodology approval. On the other hand this approach might allow to include those households without refrigerators, factoring this as 100% suppressed demand.

There was no decision precedent from the Meth Panel or the SSC WG. Winkler and Thorne discussed this problem and suggest suppressed demand of "increased service levels *of the same energy service*" (2002: 425) to be included in the baseline whereas increases in other energy services should account as sustainability co-benefits.
The basic rules for CDM, the "Modalities and Procedures", Decision 3/CMP.1 (FCCC/KP/CMP/2005/8/Add.1 p. 17) contains the following:

> 46. The baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party.

Which can be interpreted to imply that suppressed demand is eligible as avoided emissions. For the refrigeration case, the impact assessment (chapter 1.2.5) results allow to describe the "projected rise above current levels". When the 'richer' households change food purchases because the new refrigerator is operating reliably as much the poorest households, then across the range of households, the service provided changes in quality with different refrigerator contents. Another technical condition unique to refrigeration is that switching off a new refrigerator actually doesn't reduce electricity consumption because when it is switched on again compressors run continuously and thus at a lower efficiency until the refrigerator reaches the regulated temperature again. So there are good reasons for refrigerator suppressed demand to be credited but much judgement is involved in this decision.

With the good testing results from BSH Brazil another implication appeared, when the old refrigerators are only tested centrally and not *in situ* at all, then the suppressed demand is not quantifiable during the testing. Using only the baseline with the above test protocol, suppressed demand was automatically credited and it doesn't appear in the emission reduction calculation anywhere. The 24h test results is multiplied with 365 days a year. Would the SSC WG be aware of this, see it as pragmatic or as a hidden agenda and attack it for this reason? Contrary to the AIF, the higher risk strategy was chosen for suppressed demand and it was not mentioned in the first methodology submission.

Besides the baseline, the core problem on the energy side was monitoring the new refrigerator electricity consumption. BSH felt that monitoring this made no sense at all because the precision of the compressor operation was evident to them, they knew compressors either work as designed or they fail and the failure rate is so low that BSH would agree to replace any failed one, knowing the number was insignificant. However this confidence in their equipment would certainly not be shared by the SSC WG and of course the SSC WG had to assess the average new refrigerators in the market worldwide and not just those from the top manufacturers. So addressing this carefully, the first submission stated "if nameplate value is more than one standard deviation lower than the monitored in situ data" then measured values ought to be used. But it didn't include what *in situ* data was. This precaution also proved to be exaggerated and later only nameplate energy consumption for new refrigerators was put in the methodology.

The energy side is the smaller part of the GHG impact of household refrigerators because refrigerants and foam blowing agents of the old refrigerators are 2 to 4 times more CO_2e than the energy saving although they are not part of the CDM project boundary. In the first submission, the eligibility clause for the non-Kyoto gases was copied from the approved AM0060 plus a clause that CFC-11, the foam blowing agent in old refrigerators, had to be recovered according to the WEEE standard:

Eligibility

Project activities must comply with national environmental and safety regulations.

The new refrigerators to be distributed under the project activity must use a non-halogenated refrigerant and insulation foam blowing agent with no Ozone Depleting Potentials (ODP), and Global Warming Potentials (GWP) lower than 10 according to the IPCC Third Assessment Report.

Recycling of refrigerators is not required by law.

Refrigerators must be recycled at no cost to the end user.

CFC-11, CFC-12 and HFC-134a contained in the old refrigerator will be recovered and destroyed, or stored in suitable containers within suitable premises, to ensure that the recovered, stored refrigerant gases can be monitored and tracked. Stored refrigerant gases may be withdrawn from storage for re-use, or for destruction by a method approved under regulations by the host country and /or pursuant to international treaties signed by the host country under Montreal, Kyoto or other Protocol that may in the future apply.

Recovered refrigerant HFC-134a is only eligible when:

- recovery of refrigerant is performed at the recycling site;
- insulation material of the refrigerator is treated to recover CFC-11 according to the WEEE refrigerator recycling standard.

The recycling plant must include a dedicated space for controlled measurement of the energy consumption of a statistically valid sample of the old refrigerators.

This was and remains the most important property of the whole PPP not only for the one PPP product, the methodology. This was unprecedented and if it is perceived as such and repeated, adds a new policy characteristic to the whole CDM.

Later on, it appeared that the then chair of SSC WG saw that as well, when she wrote recently: "An example of 'top of the class' benchmarking can be found in a recent CDM methodology for refrigerators", (Raab 2009: 31).

At first, the eligibility clause referred only to CFC-11 because this was the basic and clearest form to do so as CFC-11 was the only Ozone-depleting substance as foam blowing agent and the only important cost component. Recovering it requires expensive machinery operating under vacuum conditions. This eligibility criterion could have been counterproductive if the costs are thereby so high that nobody uses the methodology. This criterion multiplies the environmental impact by a factor around 4 because an old refrigerator has on average 310 gr. of CFC-11, or 1.47 t CO_2e, in its foam while the energy saving of 691 kWh/yr is 0.33 t CO_2e.

Higher cost means lower number of refrigerators exchanged and so it would have been preferable to find an eligibility criterion with a lower environmental impact if that would have meant more old refrigerators exchanged. Such a volume against environmental integrity trade-off was unfortunately not available. Either the refrigerators are treated under vacuum and then the high cost, or the foam blowing agent is not recovered at all, there is no intermediate solution. Referring to CFC-11 only from the WEEE signalled that, it was not a case of using the highest possible standard for the sake of the highest environmental benefit, but it was picking the one crucial criterion only. This intention was clear within the PPP, but others and notably the SSC WG might interpret this differently.

During the discussions of the recycling standard, it became clear that it was preferable to produce a small scale methodology only. GTZ-Proklima had always maintained that there are reasons for a small scale and others for large scale one. That the volume / integrity trade-off wasn't really available was seen as sufficient reason to use only a small scale methodology and set a minimum standard. There was really no other choice. Because of the technological conditions of recycling, and the "either high investments or no foam treatment at all" situation, any methodology approach addressing the problem of old household refrigerators was in way pre-destined to be a high standard setting type. What Ulrika Raab calls above 'top of the class' reflects that CFC-11 is the only Montreal Protocol leftover. In the technology literature and in Science and Technology Studies (STS) this is well known as a "path dependency". The most popular example of a path dependency is QWERTY (David 1997). In other words, because before climate change considerations appeared CFC-11 was the technology of choice, and now those who never buy new refrigerators still hoard the old stuff, to deal with it implies such a big jump in environmental impact to the technology with climate change consideration (foam blowing agent GWP 3.14 versus 4,750). The path dependency originates in the succession of chemicals and in the investments costs for recycling under vacuum.

A small scale methodology with a high environmental benefit makes it quite difficult to undercut it with another methodology. When the environmental benefit is quite clear and is really not much of a free choice, then a different methodology with a lower threshold is unlikely to appear justified. So it was felt as a rare and suitable opportunity why not use it for what its good for !

Also there might be an additional benefit if the methodology is unavoidably characterised of high environmental integrity then it would be also suitable to push for low monitoring efforts. Demand-side energy efficiency continues to be such an unused field for CDM (as much as transport and buildings) because of the high monitoring costs and the persistently appearing operational problems of monitoring,

for example, in CFL lightbulbs, then pushing for cheap and demonstrably easy energy consumption monitoring in refrigerators was a legitimate goal in itself.

BSH's corporate strategy was also well aligned with the eligibility criterion WEEE and highest environmental benefits. Although one would expect at least for BSH to make the calculation if imposing the high recycling investments might stand in the way of selling as many new refrigerators as possible, but they did not. Highest environmental benefits was BSH strategy, cheaper recycling technologies were not explored.

Because there was no recycling with lower investment possible, the methodology should opt for the easiest or cheapest standard of certifying the recycling. There were only two recycling standards used, the WEEE-Forum standard and the RAL standard. There was no difference in environmental impact, because the quantitative goals were the same and the test protocols for certifying the recycling operation were also identical. Neither standard was developed as a legal requirement but they were nonetheless the result of a legal instrument, the EU directive for Waste Electrical and Electronic Equipment. The directive leaves recycling requirements to national legislation and elements of the RAL and WEEE-Forum standards are legal requirements in some EU countries (for example Austria, Denmark and Germany). No detail in the WEEE-Forum standard or RAL should a priori be of interest to the SSC WG because these are not the cause why it is a legal requirement in one country and not in another country. The choice of the WEEE-Forum standard was quite evident because it leaves many operational requirements open that are prescribed in RAL.

CDM methodologies should include what is needed for environmental integrity but otherwise allow projects proponents as much flexibility as possible. Policy principles in the EU such as subsidiarity are quite different. So besides the worry that the SSC WG might not approve the WEEE-Forum standard because it was part of European regulations (for instance not in all "Annex B countries"), the SSC WG might also raise many other objections that the EU directive contains elements of environmental policy that are quite different from the CDM regulations. The only good justification the PPP had was stating that it was the only one available and that it was proven technology neutral, thereby allowing different recycling technologies to compete. Especially the latter was judged as highly relevant.

The only aspect where the PPP decided to add to the WEEE-Forum standard was protection against fraud. That standard did not contain much, partially because the adherence to environmental regulation is strong in the EU but mostly because fraud in the recycling test was of little interest, the recycler wants to sell the recovered material and thus has incentive to maximise at least the valuable fractions. There is fraud in this area in the EU only on the side of the mandatory collection of refrigerators. In CDM projects evidently adding HFC-134a from other sources to that recovered from refrigerators is a very tempting way to increase income. Two controls for the HFC-134a quantity and chemical analysis of HFC-134a and refrigerant lubricants were developed (equations 3 and 4 in AMS III.X). These are quite effective because these refrigerators only function when the quantity ratio refrigerant to lubricant is in a narrow range. These two controls were the only aspect that the SSC WG did not question and they remained unchanged in AMS III.X. Nor did the SSC WG ask for information whether the factors 0.115 and 2.087 were really

representative. The choice of ARI 700, DIN 51727 and EN ISO 10304 standards was straightforward since these are the most widely used ones for the respective purpose.

One aspect where the PPP chose the way of least effort was the refrigerant leakage during refrigerator operation. In the HFC-134a baseline typical leakage during normal refrigerator use should be accounted as avoided emissions and Isobutane leaking from new refrigerator as new emissions. However, these are very difficult to measure and little reliable data is published. The simple solution was the assumption that one full charge of refrigerant was emitted in both cases. Physically that is quite incorrect, but it is easy to calculate and certainly very conservative. The latter is not a positive feature because via the not accounted CFC-11, the conservativeness was already counterproductively high. A second best solution would have been to collect survey data in Brazilian Favelas how often old HFC-134a refrigerators are re-filled. Over the CDM project lifetime perhaps three or four times and thus the avoided HFC-134a emissions are three to four times higher. Monitoring the leakage of Isobutane with a GWP of 4 would not bring significant results. Since there were already many aspects in the methodology that might create complicated arguments, it seemed pragmatic to leave the leakage aspect aside with the simple assumption of one charge as leakage.

Finally, GWP<10 was used in the first submission because all Hydrocarbons have lower GWPs than 10 and an eligibility criterion for a whole class seemed logically correct and allow some flexibility. Later it was changed to 15 only because the EU's WEEE directive uses GWP<15 although for an entirely different purpose. Nonetheless coherence in reference to standards was chosen as an overriding concern.

1.8 The interaction with the Small-scale Working Group, In-meeting conference calls

The level of interaction between the PPP and the SSC WG was high both in quantity and quality and compared to the acrimony of other methodology submissions, of unexpectedly constructive spirit. At no point was there any indication that the SSC WG or the UNFCCC secretariat wondered about the PPP, about specific objectives of GTZ-Proklima or commercial interest of BSH. Certainly the presence of Anne Arquit Niederberger played a role there because she had just negotiated the CFL lightbulb methodology successfully with SSC WG after a prolonged debate where the Executive Board queried details of the proposal for approval from the SSC WG. The other two individuals working on the PPP always identified themselves as working for BSH or working for GTZ-Proklima. Questions from the SSC WG were always directed at all three of them.

SSC 17: 1 – 3 September

In the public meeting report of SSC 17, the refrigerator methodology was described in the following terms:

17. **Integrated Refrigerator Energy Efficiency and Recovery of HFC-134a:** SSC-NM012 is for project activities involving replacement of existing refrigerators with highly energy efficient, climate-and ozone-friendly models including recovery of CFC and HFC refrigerants. The SSC WG noted that the proposed methodology is in an important area for implementing domestic energy efficiency activities with significant potential for emission reductions. While the methodology is well conceived, further improvements would be required (e.g. appropriate reference to relevant standards, guidance for ensuring comparable level of service in the baseline and project and further guidance on sampling) before a recommendation can be made.

Source: http://cdm.unfccc.int/Panels/ssc_wg/meetings/017/ssc_017_rep.pdf

This verdict shows that the SSC WG was well aware of the wider implications of the methodology for demand side energy efficiency in general. Naturally they could not have the detailed engineering knowledge about refrigerators and recycling and they took time to clearly formulate their information needs. After the SSC 17, the SSC WG formulated fifteen detailed questions about various aspects. This was effective for the PPP to collect all background information and after this first round no new issues appeared later on. The fifteen questions are on:

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_UTCXFSFU2V1HWREP6C5UOEUOVHDJVQ

The responses from PPP to SSC WG sometimes provided additional information but more often insisted bluntly on judgment required und suggested to delete the item. The following five items are the most illustrative of the fifteen:

Table 4

SSC WG Comment	PP response	PP Comment
The existing refrigerators are functioning and fully operational (i.e. not broken down) and can continue to operate for several years if usual maintenance is undertaken	Delete	This repeats 2.1, but would introduce some problematic notions. Although it is important that the fridges operate, we see no justification for the refrigerators in the worst shape to be ineligible for replacement – as these are actually the target population from a GHG mitigation perspective. In Brazilian slums, the reality is that fridges are often in very poor condition, but they are still in operation – even without freezer doors, etc
The average volume capacity of all the project refrigerators installed is with ±10% of the baseline refrigerators	Delete	Since it is voluntary for end-users to participate in the type of program covered by this methodology, using a smaller refrigerator that meets the needs of the end-user should not pose a concern for the CDM. Regarding larger refrigerators, since the energy use of the project refrigerators will be monitored in situ and compared with the baseline energy consumption, there should also be no concern from the CDM point of view: All other things being equal, the larger the project refrigerator, the more energy it will use and the fewer CERs will be issued, since the baseline energy use is independent of the size of the project refrigerators.
The refrigerators are replaced at no or minimal cost to the end-user or owner of the refrigerator (in cases of tenant occupied residences).	Delete	We do not understand the reason for this suggestion. In fact, CER revenues will not even come close to covering the cost of the refrigerators. Furthermore, this requirement directly contradicts the position taken by the SSC WG on AMS II.J. (see recent queries SSC_217, SSC_218 and SSC_220, which insist on charging at least a minimal price for efficient light bulbs).
The proposed methodology needs to better address leakage of HFC134a in the base case refrigerators. Information provided from various sources indicates that HFC134a refrigerators may not have a high leakage rate and thus claiming 100% of HFC134a related emission reductions in the year of recycling may not be appropriate and even claiming all of the emission reductions during a ten year crediting period may not be appropriate if the base case refrigerator leakage rate is less than 10% per year. In addition a significant part of the HFC may not get recovered and get released as project emissions (domestic refrigerators have small dia tubing and leakages may result at the time of recovery e.g. piercing valve malfunction, in addition the recovery unit may not	Ignore	Only the recovered HFC-134a volume is accounted for and the HFC-134a that the recovery unit does not capture would be released during the normal maintenance practice. Indeed the leakage of HFC-134a is less than 10%, the reason for claiming 100% of a charge volume is that in normal maintenance practice, the whole charge is released when the circuit is opened. As explained in Italic on page 3 of NM012, the HFC-134a emissions avoided come from the maintenance, not from the leakage during refrigerator operation. Accounting for the charge of refrigerant recovered is justified as the emission of HFC-134a when the refrigerator is otherwise deposed is avoided. Until the normal disposal, several maintenance services would emit a multiple of the HFC-134a charge. The multiple charges of HFC-134a actually avoided spread across the ten year crediting period. Accounting for the recovered HFC-134a in the year of recycling corresponds to the year when the HFC-134a is taken out of the stock of refrigerators in operation.

be able to recover all of the refrigerant contained). This would outweigh the emission reductions from the refrigerant component especially in the first year.		
Further it may be explained how the recycling of foam blowing agent is accomplished and in accordance with which national or international standard. Should there be a requirement in the methodology?	Already included in methodology	WEEE is the only widely used recycling standard. WEEE is applicable to recycling plants with different technical solutions thus allowing the plant operator to improve equipment. WEEE actually provides a suitable measurement protocol allowing a comparison of technical solutions. It is focused on the quantification of CFC recovered and by standardizing this quantification, the standard allows for further continuous technological improvements. In other words, this standard directs technological improvements in the direction of highest Greenhouse Gas impact since CFC have the highest GWPs

Only three of the fifteen questions were purely technical and easy to solve with better explanation of the parameters, for example why the vacuum of 0.3 bar is enough to suck a mix of liquid and gas (two-phase flow) out of the refrigeration circuit, or citing many studies about the energy balance of recycling. These questions concerned the correct interpretation of technical aspects, in other words questions that translate engineering into regulatory interpretation. Such questions mostly originate in professional habits of individuals and reflect problems or interdisciplinarity between business, engineering, economics and policy.

However, most questions concerned the conditions of CDM project implementation, how households participate, who records what information, what might happen to new refrigerators, etc. So most questions reflected first of all that replacing old refrigerators in low-income communities was a new type of CDM activity. These were exploratory questions, probing possibilities even unlikely ones and were therefore quite important and justified even when they did not produce any change to the methodology proposed. Especially issues around the WEEE-Forum standard and the testing according to EN ISO 15502 were important. In fact many more implications of these standards need to be considered because these standards could affect future technical changes, they might be effective during a period of time and become counterproductive later on. However the technological complexity is such that only a minor part of their content can get investigated and decided upon.

With this first detailed response from the PPP, the SSC WG then wrote the first version of AMS III.X and sent it to the PPP for comment on 18th September. In this first version the following new eligibility criteria were added:

Eligibility ***(added by SSC WG)***

All baseline refrigerators are replaced by project refrigerators within the first year of the start of crediting period by way of direct installation

Neither replacement of refrigerators nor recovery of refrigerants and foam blowing agents are required directly or indirectly by laws or regulations (e.g. to comply with safety or pollution standards), except for situations where non-compliance with the law or regulation is widespread and occurs in more than 50% of the cases.

Measures are taken to ensure that double counting of CERs does not occur. For example, CERs cannot be claimed for the manufacture of the energy efficient refrigerators installed under the project activity.

The baseline refrigerators and the energy efficient project refrigerators are driven by electrical energy.

The existing residential refrigerators replaced under the project activity must be functional at the time that they are replaced.

These new eligibility criteria do not change the ensuing CDM project in any practical aspect, at least as intended by the PPP, while they could be helpful to prevent unforeseen CDM projects. It is fair to qualify them as defensive, even so the calculus proposed in the methodology is clear and even when applied correctly by a DOE, still there are potential abuses the SSC WG sought to prevent.

After the extensive comments from PPP, the first telephone conference took place on 29th September. All members of the SSC WG and three persons from PPP were present. The SSC WG members remained anonymous towards the PPP members because the PPP members were joined last to the call and SSC WG members then did not mention their names. This format is suitable because it makes it more difficult for the methodology proposers to second-guess their regulators. During the lengthy review of the fifteen questions and detailed comments from the PPP, the SSC WG members questioned source and interpretation of data and took note of responses from PPP mostly without further reactions. A question was raised, one PPP member summarized the response again and since no further details were asked, the next question came up. After the telephone conference, the secretariat informed the PPP that since all comments had been addressed satisfactorily, the PPP was invited to redraft for first version from 18th September. This was again quite constructive because the PPP could produce new solutions and formulations into the SSC WG's suggestion. SSC WG also asked the PPP to summarize the WEEE-Forum standard test protocol for measuring the recycling efficiency because it might be added to the methodology. PPP produced the requested and re-send the revised methodology on 6th October to the SSC WG.

SSC 18: 10 – 12 November 2008

SSC WG sent a new version of the methodology on 30th October to PPP, last comments from PPP were submitted on 4th November. SSC WG then sent an In-meeting version, as a basis for the second In-meeting conference call. This was dominated by the monitoring of new refrigerators and the surveying of informal workshops.

During SSC 18, two related methodologies were also modified, AMS II.J was revised for the first time to change T&D loss assumptions and distribution surveys and the

AMS II.C was given its 11th version and the proposed leakage assumption for AMS III.X immediately copied.

The PPP members defended their claim against monitoring by referring to AM0070, while accepted as large scale, this one doesn't take account of whether end-users would have bought an efficient fridge anyway – and the project fridge could even be used as a second fridge. Thus from an environmental integrity perspective the proposed AMS III.X was already far superior to AM0070.

For the surveying of the households before the refrigerator replacement, the PPP wanted:

(i) the DOE just uses the results to make his judgment on whether the baseline scenario is valid (qualitative),
(ii) the proportion of those who say they would have bought a new fridge is used to correct the number fridges in the calculation
(iii) projects where there is a proportion of new fridge buyers above some threshold level are not eligible to apply the methodology at all.

But SSC WG preferred the following and sent a second In-meeting version to the PPP:

- Greater than 90% of targeted baseline refrigerator end-users indicate that they would either repair the existing refrigerator or replace the existing refrigerator with another used refrigerator should their refrigerator stop functioning

- Baseline refrigerators are predominantly serviced, repaired or supplied by a cottage industry[3] i.e. service shops in the informal sector which cannot be classified as a service centre or franchisee or a dealer of a refrigerator company.

This difference between the PPP suggestion and the SSC WG one was typical, they were not really alternatives or one clearly better than the other but they overlap in many aspects or approximate the same variable.

PPP decided not to respond to the second In-meeting version besides objecting to the eligibility criterion that no refrigerant recovery takes place in the baseline because it is an impossible condition to comply with, one cannot possible know that there is not one small workshop anywhere in Brazil that recovers some refrigerant. The SSC WG accepted this objection and took it out.

During all considerations during the methodology submission and approval, only one new item was proposed from the SSC WG on its own initiative, all other details were provided from the PPP, questioned and then altered. The one item from SSC WG is a clause that recovery equipment must be tested according to ISO 11650 (in paragraph 8). This is an illustration of eagerness to contribute, although a failed one because ISO 11650 is applied only when recovery equipment is sold, it is not relevant for the usage of that equipment. The PPP decided to not object and accept the ISO 11650 clause, knowing that it made no difference in practice. Possibly this was suitable as a symbolic gesture, but it also simply saved time. The PPP

[3] Such service activities are characterised by low quality service practices such as the use of refrigerant for flushing the refrigeration circuit, inadequate evacuation of the refrigeration circuit as compressors are used for evacuation rather than a vacuum pump of specified capacity and refrigerant charging is by feel or by trial and error rather than by using a charging unit all of which lead to increased direct or indirect GHG emissions.

members knew that the SSC WG member who suggested ISO 11650 was a recently hired energy efficiency specialist who might fell that he needed to justify his role.

Clearly the most important factor for the fast approval of AMS III.X was the thorough combination of regulatory and technological concerns among people in the PPP. The SSC WG raised many good questions but many more equally important aspects were not discussed. Certainly the accuracy and the comprehensiveness of the preparatory work in the PPP assured the approval because the SSC WG has excellent judgment on the quality of the information they receive. The SSC WG was recognisant of the fact that they simply did not find any error or bias or hidden agenda anywhere and hopefully rightly so, then decided at some point that it was not helpful to continue since they would not find improvements. The merit of the methodology was not to be established, that was clear to them from the start.

In the end the following four characteristics came through unscathed and these were major intentions that the PPP had pursued:

- WEEE-Forum standard or better is obligatory
- No measurements *in situ*, no monitoring required
- Households are eligible based on their economic situation
- Suppressed demand fully eligible

These environmental, social, and monitoring cost aspects reinforce each other.

1.9 Modifications in the methodology after the final form in November 2008

EB44 approved the methodology but added an eligibility criterion, limiting the HFC-134a emissions part to 15% of the total (paragraph 3 (m)). Based on the rationale underlying the methodology this criterion is not logic because the share of HFC-134a emission reduction depends on the share of HFC-134a refrigerators versus CFC-12 refrigerators among the old refrigerators replaced and secondly on the emission factor for the electricity saved. Neither of these two factors diminishes in any way the effort or impact of the project activity and therefore neither of the two factors should limit the accounting of emission reductions. The 15% criterion is not justified in the view of the PPP members.

Eight months after the approval, the UNFCCC secretariat informed the PPP members informally that it had invented the 15% criterion because the EB wanted to reject the methodology during the EB44 meeting. While the secretariat knew the 15% to have little basis, it in effect reduced the fear among the EB members that the methodology could be used to run a recycling programme without energy efficiency or that the recovered HFC-134a could be used in another refrigerator and eventually be released (at least these were the concerns expressed from EB to the secretariat).

The PPP members reject both concerns as not legitimate, these concerns do no follow from the “Modalities and Procedures” nor from any other CMP decision. The secretariat accepts that the EB members’ concerns were not justified. However, it was not possible for the secretariat to explain to the EB that, even with income from CDM, recycling is not profitable, and that HFC-134a re-use makes no difference. The secretariat saw that there is a lot of paranoia about the high-GWP industrial gases among EB members and in the wider expert community. The secretariat knew that its “quick fix was suboptimal” and the EB needed time to understand all details. The PPP members share this view, given the political considerations within the EB, the past compromises spill over to other technologies and methodologies. Indeed given the uneven professionalism and political background of EB members, the secretariat has no other choice but to second guess the EB when technologically complex details appear.

As described in chapter 1.5 above, the PPP was already anticipating such “barriers” when it wrote the first Request to the SSC WG in December 2007. The overlap between the Montreal Protocol and the Kyoto Protocol is such a policy problem that the EB takes it into account even when it is not warranted. This overlap created the controversy for HFC-23 abatement projects and it is still unresolved until today. Household refrigerators have absolutely nothing to do with HFC-23, but given the ferociousness of the controversy, the simple fact of the same letters of the alphabet “HFC” rings alarm bells in the EB. Surely HFC-23 is as much an industrial gas, as is HFC-134a a household gas because it is made for households used by households and is emitted in households. Although HFC-134a in households is an entirely different type of overlap between Montreal and Kyoto, one is always confronted with objections based on claims that all Montreal / Kyoto overlaps would share some characteristics.

The PPP members foresee that the 15% criterion will be deleted when a few refrigerator replacement projects are implemented and it will be possible to challenge the criterion based on empirical evidence.

Finally, the PPP submitted a Request to the SSC WG in order to change the scrapping regulation for PoAs, SSC_327, to which the SSC WG responded on 13th August 2009:

- The number of baseline refrigerators entering the recycling facility from each CPA recorded by the recycling facility at the time of off-loading. This number shall be cross-checked with:
  - Records of the number of project refrigerators distributed under the CPA (e.g., sale invoices etc.);
  - Transportation records (e.g., delivery notes);
- Make and serial number of baseline refrigerators, when available;
- The quantity of recycled steel, aluminium and copper (the quantities of material shall correspond to the number of refrigerators scrapped). The sales records for recycled materials shall be available for independent verification.

Source:
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_VDPVU16G754F1LEHVJKWQOR8AKSK6C

This decision to adapt the scrapping regulation, paragraph 25 (which is uniform in all SSC methodologies) to refrigerators demonstrates the SSC WG's readiness to take operational conditions into account. This formulation puts the onus on the DOE to calculate the material quantities to cross-check other records and this is an effective control of the scrapping. The judgement of the DOE is enhanced and this serves the integrity quite effectively.

Further changes to AMS III.X are being pursued by the SSC WG on its own initiative. The SSC WG seeks to broaden household eligibility and other aspects that allow to apply AMS III.X over a wider range of income levels, not only low-income communities but also middle-income households. Another possibility in that direction would be to create exceptions for all CFC refrigerators. Increasing the usability of AMS III.X will require some groundwork by CDM project proponents in different countries. The SSC WG taking the initiative to suggest to key experts to attempt further improvements is an indication that this methodology allows to clarify baseline parameters in a manner that other methodologies capture less. Possibly the SSC WG and the secretariat pursue methodology quality analysis in a variety of directions based on several tasks from the COP to the EB on assessing the bottlenecks in methodology development in general.

1.10 Efforts by GTZ-Proklima for the Gold Standard and Voluntary Carbon Standard

The Gold Standard certifies renewable energy and energy efficiency projects and excludes all other emission reductions. Furthermore it requires an enhanced stakeholder consultation and uses elaborate criteria to measure sustainability benefits. Since replacing old refrigerators is mainly about energy efficiency, the Gold Standard could decide to certify CERs from refrigerator replacements. With the exceptional environmental benefits from CFC recovery, clearly the Gold Standard's purpose of rewarding higher quality emission reduction credits supports certifying refrigerator replacements.

GTZ-Proklima approached the Gold Standard staff and presented this reasoning informally and in writing, and the director and the technical director of the Gold Standard Foundation agreed that the logic was compelling. The following is an extract of the document from GTZ-Proklima to the Gold Standard:

Worldwide, 1,200 to 1,500 mio. refrigerators with CFCs are still in operation today, although suitable alternatives are available since the early 1990s. Unintended outcomes of the Montreal Protocol include continued production of CFC refrigerators because end users are excluded in the funding criteria. Higher priced alternatives to CFC have penetrated markets where national policy worked. Emission reductions in household refrigeration should reflect the link between electricity and emissions from refrigerant and foam chemicals. Energy efficiency gains locking in refrigerants or foam chemicals with GWPs might not be environmentally optimal. A breathtaking illustration is that in the US >90% of household refrigerators use HFC-134a in the cooling circuit and in Europe, >90% use Isobutane. Electricity savings are logically linked with refrigerant and insulation foam emissions, although via economics rather than physics.
The UNFCCC (EB34) acknowledged this by accounting for CFC, HCFC and HFC as leakage when these emissions increase. This EB34 decision does **not** create the right incentives. From a policy perspective, electricity savings and refrigerant and foam emissions should be negative for increases and positive for savings. The following list is in the order of decreasing monitoring cost and some can be combined:

- VER from CFC-11 and CFC-12 only when the replaced refrigerators have high efficiency
- VER from CFC-11 and CFC-12 only when the emissions in new refrigerators are quantified
- VER for CFC-11 and CFC-12 only when new refrigerators' refrigerant and foam blowing agent have low GWP
- VER from CFC-11 and CFC-12 only when the GWP of the new refrigerant and foam is below a certain level, for example the GWP<150 used in the European F-gases regulation
- VER only when recycling standards such as RAL or WEEE are followed
- VER from CFC-11 in foam but not from CFC-12
- VER only for the electricity savings, the indirect emission reductions

However, the Technical Advisory Committee (TAC) was in charge of these eligibility questions and against the arguments from the directors, the TAC rejected the proposal to certify credits from household refrigerators. The connection of energy efficiency and direct emissions from refrigerants was seen controversially. Some TAC members were in favour others against the Gold Standard eligibility of refrigerator replacement. The opponents could not disqualify the argument that crediting HFC-134a in effect unlocks huge environmental benefits from CFC without crediting the CFC. Nonetheless the above described controversy on the Kyoto / Montreal overlap and the ensuing confusing already in the EB appeared as well in the Gold Standard TAC. Unfortunately the Gold Standard, unlike the CDM, has no mechanism to appeal its decisions and therefore the PPP could not further pursue it. Nor is there any format for publicly submitting evidence to the TAC or other way to demonstrate that information was proposed to TAC. Especially because the TAC would not reveal the reasoning by those TAC members that tried to disqualify the sustainability and the poverty co-benefits from replacing refrigerators in low-income households. The PPP members see this as a policy failure of the Gold Standard to pursue its core mission.

After this failure with the Gold Standard, the PPP produced a Voluntary Carbon Standard (VCS) methodology that combines directly with the AMS III.X and credits CFC emissions avoided through refrigerator demanufacturing, using the WEEE-Forum standard. Although it had not been foreseen in the PPP planning to create a voluntary scheme methodology, the approval of AMS III.X changed the strategic outlook for the PPP's efforts. A major factor was that methodology development in VCS is inherently weaker than in CDM because there is no format for dealing in incompatible methodologies or with equivalent methodologies with different boundaries. This increases the risk of commercial interests to block methodology development. Such blockages can also arise in CDM, as the case of N_2O projects where abatement technology suppliers compete via CDM illustrates. However due to the public scrutiny the influence of that competition is limited, whereas in VCS such cases are more severe. Refrigerator demanufacturing technology suppliers have high stakes in a VCS methodology. If one VCS methodology is better applicable to a certain demanufacturing technology, the respective supplier gains a strong competitive advantage and imposes his technology as standard.

The PPP members felt a VCS methodology on demanufacturing could endanger the achievements in AMS III.X. Two demanufacturing technology suppliers, an Austrian and a Swiss company, had already submitted VCS methodologies. One claimed to destroy CFC in gaseous state, the other to recover CFC with filters. In order to appeal to these companies that high quality VCS credits would be an overriding interest rather than to pursue competing methodologies, GTZ-Proklima invited them to a meeting on 5th November 2008. Only one of the companies attended and considered explanations from PPP members but came to the conclusion that it was not in their interest to stop pursuing a VCS methodology suitable for its demanufacturing technology and defended its technology quality claims.

Three weeks after this meeting, the EB44 approval of the methodology AMS III.X changed this conclusion and the one technology supplier then disclosed his VCS methodology proposal to the PPP. This was a constructive step that could have motivated the VCS Association to consolidate the different proposals for a VCS

methodology for refrigerator demanufacturing. In order to underline this solution, the PPP produced a rationale for VCS, shown on the following page.

Figure 17

Proklima suggestion for VCS guidelines for refrigerator recycling methodologies

In order to ensure the environmental integrity of the VCS, it is important to put certain restrictions on design parameters for VCS methodologies that involve recovery of CFCs from cooling equipment. These restrictions also create better incentives for manufacturers to innovate climate-friendly models and for investors to build advanced recycling plants.

Project Boundary (Geographical)

We recommend that the VCS take a refrigerator life-cycle approach and stipulate that the project boundary must:

- include the households where the baseline refrigerators (that are the source of CFCs for recovery) were in use. This geographical boundary could be defined in the following ways, which are presented in the order of decreasing stringency (and increasing uncertainty in the calculation of greenhouse gas emission reductions):
  - households from which old refrigerators were taken back under a CDM project activity
  - households from which old refrigerators were taken back and have been replaced with new ones using refrigerant/blowing agent with a GWP of less than 15
  - households from which old refrigerators were taken back and have been replaced with new ones that do not contain CFCs
  - households from which old refrigerators were taken back are which are identified with an address.
- exclude (i) the destruction of CFCs; (ii) the re-use of the recycled steel, copper, aluminium and plastics; as well as (iii) the milled PUR foam.

Justification

The guidelines suggested above are proposed to address three issues related to implementation modalities of the Montreal Protocol:

- Exclusion of end-users from the MP:
- Pending destruction measures:
- Effectiveness of the 2010 phase-out deadline:

In addition, we are concerned about the impacts that a CFC recovery methodology would have on the refrigerator and CFC markets, as well as related implications for greenhouse gas emissions. If credits granted for CFC recovery are not tied to an assurance that the recycled unit has been replaced by a new unit that meets certain criteria (see above) in the country in which it is being recycled, it is not possible to determine net emissions reductions (within the project boundary, plus leakage), since neither the source of the old refrigerators nor the location/characteristics of the replacement refrigerators would be known. The consequences of a failure to track the upstream activity would be to encourage an import-trade of CFC fridges from Annex I or non-Kyoto members, as well as to fail to stimulate additional refrigerator efficiency and low GWP coolant replacement.

Technical Standard for CFC Recovery

The WEEE Forum standard should be required by the VCS.

Justification

The WEEE Forum standard would ensure quality recovery of both refrigerant and foam and is therefore the preferred standard. The 90% CFC recovery criteria is required so that sufficient investment capital materialises. Worldwide perhaps 200 million old refrigerators are to be treated in a reasonable timeframe requiring large scale plants. Cheaper intermediary solutions would reduce the scope of such investments.

While the VCS Association agreed to it, other reasons to follow its “Double Approval Process” were considered of higher importance and the VCS Association proceeded

according to the methodology development rules it had given itself. Shortly afterwards, the Californian Climate Action Reserve (CAR) announced its intention to create an ODS protocol according to an entirely different voluntary market approach and to create a top-down devised methodology:
http://www.climateactionreserve.org/how/protocols/in-progress/ozone-depleting-substances-project-protocol/

1.11 Influence of NM013, AM0060, AM0070/71, AM0044, AM0046 and AMS II.J for the approval of AMS III.X, Coelba's attempts to apply AMS II.C in 2007 and 2008

Demand-side energy efficiency is a type of emission reduction with many commonalities between sectors and technologies such as the relation between manufactured product and efficiency in use, whereby the efficiency potential is shaped by one set of economic entities that passes it on to another set, households and industry. The third set of economic entities involved, utility companies, again pose another range of transaction cost problems. The UNFCCC bodies were well aware of these specific problems and have sought to deal with them on occasion. However, no policy or development tools have been issued so far.

Ghana was the background of two early experiences, one with Air-conditioners, the second with CFL lightbulbs. The latter became AM0046, a large scale methodology with prohibitively high monitoring costs. AM0046 is thus an example of a methodology development that failed through excessive regulatory ambition. Anne Arquit Niederberger seized this and initiated a small scale version based on a deemed savings approach that became AMS II.J. Initially the SSC WG imported many of the excesses the Meth Panel had created, especially the cross effect of increased heating because CFL lightbulb's lower heat emissions. The SSC WG integrated it in AMS II.C vs.10 during SSC 17. The SSC WG had just finished its work on lightbulbs when the refrigerator methodology was submitted by the PPP.

Altogether five large scale methodologies influenced the SSC WG, boiler efficiency AM0044 (approved EB28), AM046 (EB29), the chiller replacement AM0060 (EB36) and the refrigerator manufacturing ones AM0070 and AM0071 (EB39 saw fundamental objections but EB42 agreed). It is important to recall that none of these five methodologies has ever been applied in a CDM project. While these five are the only among almost 100 approved methodologies that concern appliances.

The first introduction of refrigeration aspects by the SSC WG was the adaptation of AMS II.C after the chiller methodology AM0060 was approved. There the SSC WG copied Meth Panel results without changes. When EB44 approved the refrigerator AMS III.X, SSC WG still maintained the cross effect in AMS II.J (copied from AM0046) but it dropped the refrigerant clause that the PPP had copied from AM0060.

Although these deliberations took place when the microphones were switched off, it is evident that EB44 (in Poznan) did not yet allow the SSC WG to deviate from the Meth Panel. The chiller methodology's clause for refrigerants was the first instance to deviate and easy to justify because AMS III.X had the more stringent explicit GWP<15 clause than the refrigerant clause in AM0060. Only at EB47 the first changes to Meth Panel results were allowed notably the exclusion of cross effects and the baseline penetration factor in AMS II.J. AMS III.X went through by being more conservative than AM0060 however, small scale should be less conservative. This was then achieved step by step.

While the SSC WG still could not influence the EB to drop the cross effect before EB47, it gradually loosened the demand on pre-installation surveys, thereby learning how much room to give to DOE's interpreting survey results and it gradually reinforced the statistical accuracy of 90% as a suitable threshold. In this situation the two major aspects of AMS III.X, the sample for testing of old refrigerators and the avoidance of monitoring the new refrigerators, "sailed through" because they would not endanger the large conservativeness from the CFC emission reduction.

AM0070 and AM0071 were twice sent back to the Meth Panel for further changes, at EB 39 and EB41. During EB 41, a EB member argued "the reduction is made by the consumer not the producer, the EB has no mandate to reward producers". The counter argument was that both sides are necessarily involved. Others insisted that the EB had no mandate to favour the demand side. The Meth Panel resisted the calls to change AM0070 and 71, and argued that there was no basis to favour either producers or end users of appliances. Thereby the precise interpretation of the "Modalities and Procedures", Decision 3/CMP.1, stood in the way of supporting those methodologies creating more social co-benefits. Different opinions in the EB started with the same initial direction "the EB has no mandate to…", in other words EB members try to keep check on each other who is more faithful to the core principles. A more forceful EB might have decided to quantify the relation between the producer and the consumer part in the emission reduction and create a demand to COP to get a clear mandate (other issues Chapter 2.6, p.9x).

Another analytical aspect that the EB could not touch was the relation between efficiency and refrigerant. These two methodologies separate energy efficiency and direct emissions from refrigerants, AM0070 is for manufacturers that have already switched to Hydrocarbons and AM0071 is for those manufacturers that have not changed. A more forceful EB could have decided that this is an issue it can intervene on by producing a technologically grounded justification why this division is effective or not. The first recommendation from the Meth Panel for AM0070 was produced during the MP meeting that finalized the chiller AM0060. Very likely the confrontational experience with the proponent of AM0060 led the EB to not repeat this, although for household refrigerator production it turns out differently than for the chiller replacement.

Directly related to household refrigerators was the case of mobile air-conditioners (MAC) where HFC-134a is replaced with Hydrocarbons. This practice is standard in some countries (and sufficiently researched and published), notably Australia were 15% of all MAC systems use hydrocarbons. This methodology was first submitted in May 2006 with the Request SSC_052. Altogether nine versions were debated until it was finally rejected after almost three years of deliberations between the SSC WG

and the methodology proponent, during EB46 (versions were SSC_184, SSC_171, SSC_151, SSC_131, SSC_95, SSC_87, SSC_66, SSC_057, and SSC_052). Similar to the procedures for the refrigerators methodology AMS III.X during the SSC 18 (chapter 1.8), the SSC 15 meeting responded with an In-meeting methodology proposal called "Natural refrigerants in after market mobile air-conditioning", where several parameters were re-defined. The proponent had included the destruction of HFC-134a, an indication how he struggled to find ways of responding to the SSC WG concerns. This indicates that SSC WG and proponent did not manage to find common terms for the boundary because HFC-134a destruction is no necessarily inside the boundary and when the PPP defended this for AMS III.X, the SSC WG accepted quickly. The failure of the MAC methodology is an illustrative case study failure because both sides tried hard and with much persistence, however insufficient mutual understanding could no be bridged. The underlying technology is not complex, the wide applicability and environmental impact was unambiguously clear but operational variables remained uncertain. The final decision to abandon it by the SSC WG reflected increasingly disillusion that the methodology proponent could not provide the needed evidence that the SSC WG had felt was there. Another attempt at MAC was NM0323, concerned vehicle end-of-life emissions from Air-conditions. It was rejected by the Meth Panel meeting in January 2010 unfortunately, the Meth Panel did not refer to the previous SSC WG work.

Coelba submitted a PDD for its refrigerator replacement programme in June 2007 and in July 2008, both with AMS II.C. The first one Coelba bought from the Brazilian branch of a US consulting company but it lacked almost all monitoring information and was without exaggeration a fake, not uncommon for a buyer of a PDD with no experience assuming that a well reputed company would assure that its products have quality. For example, the PDD "B.6.2. Data and parameters that are available at validation" simply said "Not applicable". Furthermore it mixes 17,094 refrigerators and 154,464 lightbulbs in the same PDD, ignoring all the lightbulb monitoring work being done for AM0046 in Ghana. GTZ-Proklima pointed this out to Coelba in writing in June 2007.

This same company but this time the US headquarter produced the Request SSC_362 (see p.34). This request seeks to import the progress from AMS III.X to AMS II.C. Thus it is evident that the CDM consultants in the headquarter are more competent than those in Brazil. Perhaps donor competition also played a role because Coelba cooperated frequently with USAID and USAID's energy policy and CDM advice might be seen as alternative to GTZ's advice.

The second Coelba PDD was written by the Gold Standard representative in Brazil, a quite experienced CDM expert. This PDD has all details required (is twice as long) and shows details of the 66 different Favelas where refrigerators were replaced and the numbers of Agente Coelba involved. This PDD included monitoring details in an effort to compensate for the deficits of the first PDD, however, it overshot this goal. It stated multiplying nameplate capacity with 24 hrs/day would not allow conservative project emission estimates, precisely one breakthrough that AMS III.X has achieved. Similarly more detail than useful was provided for Coelba financial parameters. The major reason for the failure of this PDD was that one consultant was used for the PDD and another for monitoring measurements (Prof. G. Jannuzzi) by a leading international expert. Giving the task to one of them would have avoided the problem.

Typically multiplying high quality sources of advice then leads to the impossibility to integrate the competences.

The PDD sections A-C, that GTZ-Proklima had submitted with the proposed AMS III.X also used information from Coelba. It was published on 17 July as NM012 on the UNFCCC website and the Coelba PDD appeared on 29 July. Undoubtedly, the SSC WG saw that these two PDDs referred to the same activity and had conflicting statements on several parameters. Smaller differences were assumptions about leakage and the detailed information on the BSH refrigerator in the GTZ-Proklima PDD, while Coelba had not indicated in its PDD that the refrigerators exchanged were all manufactured from BSH. Throughout the discussion between GTZ-Proklima and the SSC WG nobody mentioned Coelba's own PDD, because the assessment of a methodology has quite different criteria than those for a CDM project registration. This might also express a comparative judgement on the two PDDs.

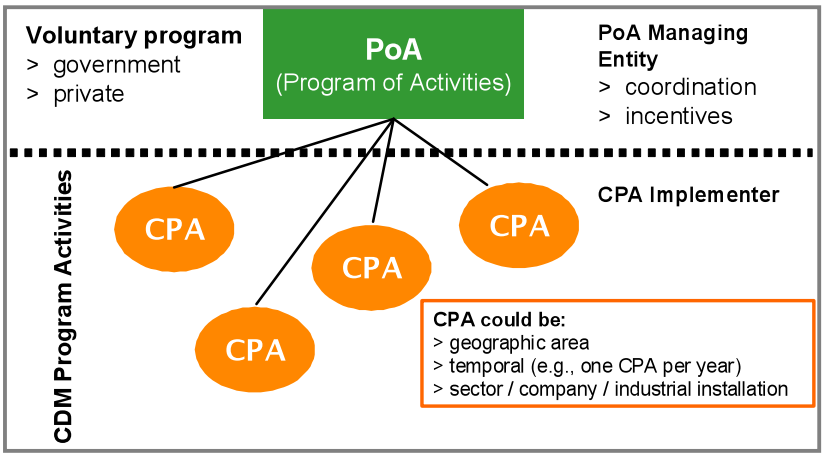
Summing up, importing elements from other methodologies played a major role in the approval of AMS III.X but not in a coherent manner. An import from AM0060 was refused, others from AM0046 accepted. Sometimes one can claim similarities must exist, for other parameters that differences must be upheld. Some might interpret this as contradictory behaviour from a regulator, if one assumes that a methodology can express the complete set of policy principles for CDM. More convincing seems the explanation that operative parameters are always so context dependent, that in fact, CDM project proponents can even implement a methodology and report monitoring parameters in ways to exploit trade-offs between policy principles. One methodology is hoped to bring particular operative results, and therefore copying from it is encouraged but later on the judgement of a methodology changes and the EB tries to avoid it.

1.12 Support for BSH / Continental for a PoA CDM after the approval of AMS III.X

In the beginning of 2009, BSH Brazil was in discussions with three utility companies for joint CDM projects, CEMIG, Coelba and Light (Rio). Following the February 2008 meeting with CEMIG, CPFL, BSH and GTZ-Proklima (chapter 1.6), BSH Brazil had several further exploratory meetings with CEMIG during 2008 but no conclusions about a suitable CDM design appeared. BSH Germany continuously advised BSH Brazil, while GTZ-Proklima waited for BSH Germany to indicate what advice was expected. As outlined in chapter 1.2.3, from the start of the PPP the division of work between BSH and GTZ remained, BSH had to come to an agreement with a utility sharing cost, benefits and risk. GTZ-Proklima's advice was clarifying options, but wait for BSH Brazil to provide information on the utilities' preferences. With the approved AMS III.X, it was hoped that utilities' would have more confidence in BSH being able to overcome the administrative problems of CDM project approval. BSH Brazil felt the new methodology's potential was clear to the utilities and no particular effort from GTZ-Proklima was needed to explain it.

GTZ-Proklima stressed that the division of responsibilities in a PoA CDM was flexible and BSH and a utility could decide who among them would be managing entity and who would be implementing entity. Each PoA must include an operational plan dividing the actual tasks between managing and implementing entity freely. The most effective division proposed by GTZ-Proklima was for BSH to assure all monitoring and recycling tasks, and for a utility to take all household side work. The interface between the two would be the point of exchange of refrigerators where households provide proof of address and the utility certifies the past payment of bills.

Figure 18



BSH Brazil continuously tried and failed to provoke a utility to identify what CDM design it preferred because the discussions did not pass the commercial stage of dividing the income from CDM (CER sales) and the costs of new refrigerators. Since all utilities were to use their *wirecharge* budgets for the CDM, it seems likely the commercial compromise was not the reason but the unprecedented character of the decisions that utilities were not able to create.

Since 1st July 2009, the new owner of Continental was the Mexican company MABE, under the name MABE/Hortolândia. Thereafter, BSH could not undertake any independent initiative in Brazil any more. MABE acquired the full set of technology from BSH, including the most efficient refrigerator technology with 180 kWh/yr energy consumption, 25% more efficient than the previously leading model in Brazil. The person who pursued the CDM work under BSH's control kept his position and continued to be responsible for the negotiation with Coelba. As a non-European company, MABE could not participate in work partially paid for with PPP funds from GTZ-Proklima. However, BSH Germany could act as an intermediary, receive input from GTZ-Proklima and decide to provide it as a free service to MABE.

Coelba informed GTZ-Proklima in August 2009 that it accepted to pay for expenses if GTZ-Proklima helps developing a PoA CDM between Coelba and MABE. Coelba's preference was to create a PoA for the three utilities comprising Neonergia, Coelba, Cosern and Celpe, and to be managing entity of the PoA. Coelba's offer to pay expenses supports the assumption that the commercial side of CDM was not the main barrier for BSH to come to an agreement with Coelba. Whereas before BSH delivered all new refrigerators for Coelba's refrigerator replacement, Coelba had then started to buy the new refrigerators from MABE and Whirlpool engaging a price competition between the two. MABE was a brand with significant lower value in Brazil than BSH and therefore Coelba considered that households might prefer Whirlpool's models. Coelba also expressed that the performance of MABE had declined after it had taken over from BSH.

A last effort was then to provide a complete PoA-DD and CPA-DD to BSH Brazil, written for Coelba to be implemented in Salvador. All remaining open issues were explained in detail indicating the choices and how Coelba and BSH could agree to define the missing parameters. The emission factor calculation used an Operating Margin / Built Margin of 0.75 to 0.25, and thus 0.3938 t CO_2 / MWh, one third higher than typical for Brazil, justified with the predictability of the baseload demand reduction of household refrigerators. This translates to 0.34 CER p.a. per refrigerator. MABE was defined as managing entity and as implementing entity. The operational and management plan consisted only of activities by MABE. The PoA-DD and CPA-DD was sent to MABE and to Coelba, and this was the final activity of the GTZ/BSH PPP. At the end of September 2009, these PoA-DD and CPA-DD were subjects to a telephone conference with MABE but MABE could not provide more clarity on the preferences in CEMIG, Coelba and Light. BSH's sale of its Brazilian branch and the inertia of the utilities did not allow to bring the PoA to a submission to the UNFCCC.

Similar PoA-DDs were also produced for a Brazil – wide PoA. It should be possible to have a CPA with MABE as implementing entity and other CPAs with the utility as implementing entity. However the eligibility criteria for CPA and the Operational and Management plan of the PoA must accommodate all particular requirements from utilities because these cannot be changed. This problem can certainly be overcome. The Indian lightbulb PoA from Bureau of Energy Efficiency intended to cover all Indian states is failing there. If a utility insists on particular management details incompatible with a PoA it is always possible to create a new PoA however the administrative delays of one or two years are a bigger disadvantage than the additional cost.

1.13 Lessons Learned for BSH

Producing a first-of-a-kind CDM methodology allows to impose emission levels as threshold and as benchmark

This can force low cost competitors to raise their product quality

Long delays and bureaucratic barriers (even from the U.N.) are not a constraint and well prepared CDM proposals get a considerably faster treatment

Consumer classes can become CDM project parameter specific and furthermore refrigerator purchase decisions can be linked to electricity bills, in particular when utility regulations for low-income communities exist

Business models can be influenced by using new CDM boundary definitions

GTZ is a valuable source of information about the carbon markets, where to find expertise, and how to find out what expertise is effective

1.14 Lessons Learned for GTZ-Proklima

The inertia of partially privatised utilities in Brazil cannot be overcome by offering opportunities to create and implement low-income consumer policy or climate policy

Understanding related and recently submitted CDM methodologies is effective to predict the chances of a new one to be approved

At the time of submission significant characteristics of a methodology are still appearing and the final quality rests to 50% on the preparation of supporting evidence to review with the UNFCCC bodies

Compliance CDM projects can be shaped by methodologies and in particular outstanding environmental integrity established as best practice benchmark

Whereas, voluntary projects need actual project financing and implementation as well to achieve the same level of impact

Public-private Partnerships are effective to innovative in CDM because UNFCCC bodies and national bodies accept the compatibility of climate policy objectives

Public-private Partnerships with technology leaders requires careful assessment of their business processes to align CDM project operations to them

Large private companies with international subsidiaries bring additional barriers from intra-company competitive relations

Chapter 2:

Impact of the PPP results and definition of future CDM work

2.1 Current state of the CDM reform debate and overview of proposals for methodology development and the CDM approval process

CDM is one instrument to achieve GHG reductions, producing a price for carbon and the transmission of this price between as many and as diverse as possible sectors of the economy. Compared to taxes and subsidies in various forms, CDM should allow to minimize the cost of achieving a certain emission reduction by making unlike opportunities comparable, i.e. power plant technology changes comparable to insulation of houses, comparable to reforestation and so on. The success of the CDM is primarily judged by the price trends and by the emission reductions achieved. Market instruments are intrinsically superior to any other instrument only when the cost signals transmitted allow to spread financial effort, that is to say, when a very large number of individual decisions are influenced in a nuanced manner. Economic theory calls this condition a Pareto-optimum, no other market actor can gain without another one getting a lesser benefit. Because of the nature of infrastructure systems and especially grids like electric power, natural gas or oil distribution, the superiority of market instruments are even more relevant for climate change mitigation.

As background for commenting on the PPP, the fundamental critique of CDM as an instrument for example by Wara is excluded (also Böhm and Dabhi 2009). Most of Wara's arguments are too selective such as: "The data also indicate however that because of the limited supply of CDM projects, the price of CERs is likely being driven by the EUA price rather than the cost of emission reductions in the developing world. Thus the reduction in the cost of compliance is coming as a results of the markets perception of an increase in risk and not, as intended, due to the lower cost of emissions reductions in the developing world" (Wara, 2008). In order to qualify a particular CDM type or project or methodology, one has to assume *a priori*, that price signals are an essential part of policy and that no other way of providing the same function is known (internalising externalities). To appreciate CDM as a whole, as Wara attempts, one needs to assemble similar CDM outcomes in many countries and project types. To assess a particular CDM project or methodology one must assemble comparable or average CDM market outcomes.

Also excluded are all questions of the synergies between CDM and taxes or CDM and feed-in-tariffs for renewable power, and so on. A market for carbon alone is not a sufficient condition for climate policy and each market segment has specific policy linkages that might be beneficial. There is a market of sufficient size so that policy is possible. The best judgment of the potential of the carbon market is as often the Öko-Institut: "The CDM has also had a great impact on the thinking of business and policy makers in developing countries and the awareness and understanding about clean technologies, emissions trading and future action on climate change both in the private and public sector. Moreover, the CDM has considerably changed GHG emissions of some gases and some sectors in developing countries." (Schneider, 2008). The influence of the carbon market rests on many national policy elements and assessing those is not relevant for CDM per se.

First the official CDM reform arguments by the UNFCCC are described. Afterwards the older reform arguments are reviewed that are known but have not received much attention recently.

Raab (2009: 3) distinguishes nine areas of calls for change "in the way the CDM operates concerning
uneven distribution of projects,
under-representation of sectors or project types,
differentiation (of rules between countries or continents),
additionality,
administrative and organisational issues,
windfall profits in certain low-cost projects,
interpretation of sustainable development,
pure-offsetting and
technology transfer. "

Raab also sees two areas of on-going improvements PoA and sectoral crediting. These nine areas include all factors for CDM reform and correspond to an ambitious policy agenda of what CDM should achieve. Other commentators and policy makers content with a less ambitious role for CDM and then exclude some of these nine areas. This CEPS Task Force Report should be a suitable point of reference because CEPS provides advice to the body seeking the most ambitious improvements to the CDM prior to COP15, the EU. The Report lists those areas effective to be addressed in the COP15 negotiations, they related and by joining them make successful negotiation more likely. In each of these nine areas of CDM reform, several proposals are being debated. Besides the two are actively pursued reforms PoA and sectoral crediting, the EB meeting during COP15 has initiated a reform of CDM administration.

Of these nine areas of CDM reform, three are described in more detail here because the PPP affects them directly, the under-representation of sectors, sustainable development, and technology transfer. For these three ongoing reforms, the PoA debate is also described because the PPP produced such a PoA.

Preparing COP 15, KfW provided a public comment to the UNFCCC:

> In our view the inefficiencies in the CDM operation are up to a high degree caused by imperfections in the interaction of the main CDM stakeholders; the COP/MOP, the EB, the secretariat, DOEs, DNAs and the project proponents and developers. In particular COP/MOP and the EB don't seem to utilize the full support potential of the secretariat and the available knowledge and expertise in the CDM market to inform their decision making. To take full advantage of the market's expertise we suggest broadening the interface of the secretariat to the CDM market in:
>
> 1) Opening a communication window on the interpretation of CDM methodologies, guidance and procedures e.g. in establishing an appropriate client-oriented service unit within the secretariat
> 2) Establishing the instrument of calls for temporary expert advisory groups that informs the discussion in the secretariat and its provision of analysis and draft decisions to the EB

If this KfW comment is representative, then the current efficiency of CDM is still shaped by "teething problems", the institutional set-up has not been thoroughly reviewed and not been aligned with the main thrust of market participants. Despite the 1,860 CDM projects registered (at the end of 2009), the process of judging and administrating CDM projects is uneven and the results not coherent. Many

commentators agree to this judgement, however, views on causes and remedies are quite divers.

A set of proposals prepared for COP15 by the UNFCCC for reform of the CDM illustrates that KfW's diagnosis of the interactions between main CDM stakeholders is pertinent. This set included:

- an overhaul of the review process
- an appeals system for developers
- a reduction in the amount of time the board can meet in private
- a move to protect developers from the impact of suspending auditors
- a move towards standardizing baselines in some countries
- a move towards creating a positive list of projects that could avoid additionality rules but earn fewer credits
- a first step to include some form of crediting avoided deforestation
- a fund to build capacity in some countries and pay for the validation fee or projects in those countries.

The failure of COP15 meant that none of these eight reform items has been agreed or even brought to a final form. It is generally evident that there is no disagreement on the need for reform and the reasons why these eight items would lead to significant improvements. When there were confrontations on CDM during COP15, these always concerned substance not process. One party objected to CCS, another to REDD, and so on. The confrontations play out rather on CDM project types and not on the more analytical details, what variables to include for financial additionality of wind power in China, for instance.

These eight reform items would affect and change all of the nine areas of change defined by Raab et al.. These reform items are the technical core where sufficient evidence exists from the CDM projects created so far and lessons can be translated into changes irrespective of policy differences among parties.

So overall CDM reform is slowly advancing, as the international negotiations permit from time to time, and the aspects of CDM reform on process are well formulated and visible. The EB has drifted into a chief comptroller role, delegating authority was avoided instead of expanded. The EB members are under intense scrutiny from their Ministry of origin and are increasingly unable to operate. Information exchange between all stakeholders is too slow and too formalistic. The annual report for 2009 from the EB already outlined half of the reform items: overhaul review process, appeals system, standardized baselines, and positive list. These reform items from the EB were all taken up and extended for COP15, as a "Proposal by the President", produced within the UNFCCC secretariat (despite its name). This document is still a Draft, but it continues to guide reform efforts. It is maintained at each EB meeting, for EB52 on:

http://cdm.unfccc.int/EB/052/eb52annagan15.pdf

The extensive copying from the EB annual report (or paraphrasing it) to the "Proposal by the President" indicates that these conclusions are generally accepted. Some are only wishful thinking because they do no correspond to meaningful operative changes. But it seems quite useful to keep formulated goals so that eventually ideas for operative changes appear later on. Besides the copying, there are differences, where the President's Proposal goes further than what the EB declarations. One

should not read much into these differences because the President's Proposal is more forceful also because it does not bind its author, whereas the EB declarations makes the EB the subject to criticism. For example the "President's Proposal" contains the fourth reform item, protecting developers from losses of suspended auditors, easy to demand but difficult to operate. Similarly, the President's Proposal is more ambitious for simplifying additionality while keeping quiet on endangering the environmental integrity concern.

Progress on all eight reform items will be slow but the impact of each one will be significant. The highest impact will come from the overhaul of the review process and the creation of another body, the "Project Assessment Committee", (PAC). At first PAC's efforts will inherit all the weaknesses from the EB's review work, however, over time PAC will find better ways of assessing the PDDs coming in and DOEs will learn how to use them to ease their checking of PDDs. Hopefully the EB will use the repeated and increased mandate to delegate its authority especially to PAC. EB to PAC relations will require trial and error to evolve over time, like those will all other CDM bodies.

One absentee from these CDM reform efforts is the stakeholder consultation. The criticism is well evident, from developers cut-and-pasting consultation record in PDDs, to the ritualistic content and the abundant lip-servicing by the stakeholders who bother to show up. One day, someone will venture a proposal that distinguishing the purpose of the stakeholder consultations between project types is just as justified as distinguishing the additionality and the baseline. For the moment the consultations rest a holy cow.

Efforts in countries with less than 10 projects concern simplified methodologies and preferential treatment from DOEs and the secretariat, but most importantly loans for PDD writing and validation. Time will tell which of these means will be effective but for neither of them the chances are high. After COP15, claims for more small-scale methodologies to re-balance the regional bias in CDM projects appear more and more in the EB. This connection between regional issues and methodologies also indicates the inability to identify regional problems. There is no analytical assessment of the strength of this link. The second remedy for regional bias, standardized baselines in underrepresented countries is certainly stronger. Baselines are costly and risky and using standardized baselines are attractive for new CDM project developers. There is no evidence that countries with less than 10 projects have different GHG emissions and so it is not clear why there might be any different methodologies for such countries.

The GTZ/BSH PPP created AMS III.X and the evident question is whether it reflects current methodology concerns and methodology development reform concerns. Clearly the attention and scrutiny from the SSC WG indicates that this methodology corresponded to the current concerns. Is this still so after the proposals for COP15 have been debated ?

CMP4 (paragraph 35 of decision 2/CMP.4) instructed the UNFCCC to conduct an assessment of the reasons for the slow progress of methodology approval, the impact of the approved methodologies, the priority sectors missing and corrections in the current UNFCCC procedures. The results fed into the EB Annual Report 2009

and the President's Proposal but a number of them were not taken up and deserve to be highlighted here.

The time needed for methodology decisions was judged as excessively long because methodologies become more complex, specialist expertise difficult to find, and the interaction with proponents is too slow. Only the last one was really taken up through a number of suggestions for intensifying the interaction with proponents, not only for methodology work and even more so for the registration process. Suggestions for new ideas to access specialist expertise and to create more modular methodologies were not pursued because other process changes are more effective. The methodology consideration pursues four criteria: meeting deadlines, transparency, consistency and usability. The later is new as a self-standing criterion, it receives more prominence. Low usability of most methodologies is seen as a major factor for the extreme concentration of approved methodology usage. Specific efforts to increase usability are hoped to contribute to more diverse methodology application.

Only 13 methodologies account for 88% of the emission reductions. Four types of methodologies, generation to the grid, industrial gas destruction, methane and waste energy recovery together correspond to 92% of all emission reductions. Obviously these two results indicate that the methodology consideration process has unintended biases. An extensive survey by the secretariat about the reasons for the non-usage of two thirds of the approved methodology produced no insights as to why this is the case. The secretariat derived a list of 14 action items (discussed at EB49), from more input from proponents on risks, better access to expertise, more prioritization, specific usability requirements and modular methodologies. Neither of these items (only prioritization) were taken up as such, and the EB assumed that the methodology development will change with many other changes in the overall governance of the UNFCCC, rather than narrow changes in the methodology consideration.

The insistence on usability reflects also that no other plausible explanations for the astonishing concentration of methodology usage was found. It is possible that more opportunities for proponents to explain their needs and views on applying a methodology itself can correct the concentration of methodology usage. The UNFCCC increasingly accepts that methodology users are the best judges of usability and the EB cannot produce equivalent criteria to judge methodologies, intensive interaction with proponents is thus required. Specific terms of reference for interaction between the EB and proponents, secretariat and DOEs, and between panel and working group meetings and proponents are yet to be established but the potential for improvements is high.

Why do teething problems persist after 1,860 CDM projects have been approved ? History of economics and economic sociology provide a particular answer. The instrument CDM created a new market, in existence for five years now. As Callon (2009) points out, constructing a market requires an enormous degree of 'cooling': of knowledge, of metrologies, of actors, of identities, of interests. The cooling metaphor expresses that all these things have to be discovered and then, by appearing as stable, change in temperature so to speak. They are anticipated and confidence increases. Cooling reduces transaction costs.

2.1.1 Under-representation of Sectors

The EB annual report 2009 suggests a positive list of sectors, initially small-scale renewable energy and energy efficiency, for an alterative to the additionality tool (para 13). "Positive" implies while specific rules could also apply elsewhere, only these are eligible to give them more support than those sectors excluded. Whereas the EB requests input from the secretariat on the thresholds[4], the President's Proposal already suggests 5 MW and 20 GWh/yr, but relates this to general additionality changes not to sectors. The EB is less optimistic for overcoming sectoral biases with a prioritization of methodology consideration than the President's Proposal because the EB proposes to support sectors with simplifying additionality criteria which is stronger than only giving some methodologies preferential treatment. The President's Proposal focuses the strongest incentives, loans for CDM preparation and top-down methodologies, only on countries with less than 10 CDM projects not sectors. There is some ambivalence here between means and ends. Either one can select methodologies more relevant for less active countries, assuming they do appear anyway, or one needs to create them because they don't appear otherwise. Respectively either one identifies methodologies for underrepresented sectors or one attempts to increase incentives through simple additionality test for such sectors.

The choice of support given to specific sectors depends on the judgement of the methodologies that appeared in the past. Many methodologies for transport and buildings were proposed but rejected. If one assumes that these were quite good and then cooperating more intensively with the proponents is suitable to support these sectors. Or if one assumes that the rejected methodologies for transport and buildings were not enough in numbers and/or of poor quality, then supporting these sectors requires other efforts to assure that different methodologies are produced. "Top-down" assumes the Meth Panel and the SSC WG are more competent and can produce superior methodologies compared to those proposed in the past. This is far from evident. Commercial CDM developers such as Ecosecurities, MGM or First Climate are dynamic ventures. There are plausible explanations why they venture less into energy efficiency because they have less control over the emission reductions achieved as these depend on actions by plant operators. However the strength of this explanation is not certain. The most influential methodology developer is the World Bank. It was involved in around one third of the approved methodologies and it is certainly not constraint by a need to assure access to CERs.

Without a result from COP15, it is possible to use the results from EB51 (just prior to COP15) and assume these reflect what COP15 would have produced. And as argued above, the process reforms tend to allow consensus among the parties. The official result from the EB51 for priorities to reform CDM in relation to methodologies is the following:

[4] The threshold is crucial by defining technologies and industry sectors. First, small-scale methodologies with easier additionality criteria were allowed until 15 GWh/yr. Later this was raised to 60 GWh by EB27 because too few small-scale projects appeared. The 60 GWh threshold is considered quite successful and small and large scale CDM project appear in similar numbers.

Figure 19:

Annex 11

PRIORITIES OF THE WORK OF THE BOARD ON METHODOLOGICAL ISSUES

(Version 01)

1. The Board agreed to define the following order of priority of its work in methodological issues:
   (a) Development of tools and considerations of cross-cutting issues;
   (b) Requests for clarification;
   (c) Requests for revision;
   (d) New methodologies.
2. The Board agreed to define the following sectors as priority sectors:
   (a) Energy for households;
   (b) Transport;
   (c) Energy efficiency in construction;
   (d) Agriculture.

The order of priorities is significant as it implies the EB's view where its own agenda can progress effectively. Households are seen as the most important sector to pursue. More methodologies for households are expected to create high impact on sustainable development as well as an improvement of the regional distribution of CDM projects. At present only four methodologies are approved, II.C, II.G, II.J, and III.X. The first one (created top-down) is already in its 13th version, but has only been used 25 times in six years. And most of these 25 are lightbulb CDM, the object of AMS II.J (produced by the World Bank). The latter has been used 17 times within its first year (in PDDs submitted for validation). The refrigerator methodology is thus only the second one for households. The fourth, II.G, for non-renewable biomass does not target households specifically and does presently not allow to refine its application in households. It was subject to the first practitioners' workshop for a methodology organized by the UNFCCC in October 2009, no changes to II.G appeared to far.

The product of the PPP, AMS III.X, allows to expand the focus on households beyond lightbulbs, undoubtedly a welcome contribution. Other potentially relevant aspects would be standardization of the baseline, tools, and cross-cutting issues. AMS III.X contains one innovation allowing to pursue a cross-cutting issue, the inclusion of recycling in the boundary. In this case, it is an imperative inclusion because of the high GWP of the CFCs in old refrigerators. The UNFCCC might pursue this further as a general rule how appliance recycling should be included in boundaries and advanced recycling standards (such as WEEE and RAL) used or reduce these requirements depending on the types of households participating.

Low-income households as a specific target group have not been pursued in any other methodology besides AMS III.X so far. One early precursor for this has been

the Kuyasa CDM project in a township of Cape Town, South Africa (ref. 0079). Although it was registered in 2004, it has not been repeated. A monitoring report is approved but no certificates have been issued (end of 2009). This should be interpreted as a major failure of ODA in general. Kuyasa has been well documented by the University of Cape Town, demonstrating the factors for such CDM projects so as to enable others to build on this experience. Steve Thorne has used it to produce a methodology for solar water in households that has been rejected repeatedly.

Chapter 1.9 outlined how the secretariat is continuing to work on AMS III.X on its own initiative. In light of the EB's own priorities this is to be expected because it is one of only two available to pursue this priority sector. The focus on households as a conclusion from the UNFCCC's assessment of methodologies is evident since EB47 when the assessment was first discussed. At EB49 to the following conclusions were drawn (as presented by the secretariat):

Figure 20:

EB 49: USE OF METHODOLOGIES

Just 13 methodologies (AMs and ACMs), account for 88% of the potential emission reductions.
Grid connected electricity generation related methodologies have the highest potential (ACM0002, AM0029 are among the top three)
Industrial gas destruction methodologies (AM0001, AM0021, AM0034, AM0028 are among the top 14)
Methane emission avoidance methodologies related to waste (landfill, waste water treatment) or coal mine operations (ACM0008) or oil and gas sector (AM0009
Waste energy recovery methodologies (ACM0004 and ACM0012)
These four types of methodologies accounts for 92% of all the emissions reduction of the registered and under validation projects using AMs or ACM

Key priority sectors and types of projects with no or very few methodologies

Transport sector, Mining and mineral production and Construction have the lowest number of methodologies.
The transport sector has a high potential for emissions reduction. Decision 2/CMP.4. also encouraged PPs to submit methodologies for the transport sector. It is a key priority sector where additional methodologies are required to be developed.
Energy for household is also a key sub-sector where availability of more methodologies with increased usability could result in both the development of additional CDM projects with a high impact on sustainable development as well as an improvement of the regional distribution of the CDM projects.
EE improvement in construction (panels and bricks with less CO2 emissions intensity) has also an interesting potential of ER and impact on sustainable development.

The 13 most used methodologies have mixed origins. Some appeared in competition among CDM developers, others were consolidated by the secretariat,

and others initiated top-down. It should be stressed here that the causality between the dearth of usability and the absence of sectors is a macro observation and there are no micro studies of this causality available. Is the usability of a few methodologies due to the sector (then it is tautological) or due to the methodology development work ? To determine the latter, studies are needed that show methodology developers from certain sectors lacking some capacity that those in successful sectors have.

Influential CDM experts such as Bosi, Figueres, Michaelowa and Niederberger stress different aspects to explain usability. Figueres refers to the *long tail* part of end-use efficiency, focussing the problem of a baseline for dispersed emission reductions. Households are in this long tail as well as pumps or electric motors. For *long tails*, PoA and sectoral crediting are the whole answer required. Another focus is the *split incentive* problem, those who make the investment are not those who pay for the energy cost of using the equipment. Some see this as the fundamental cause of sectoral biases. Niederberger suggests to take the differences between discretionary retrofits, planned replacement and new installations into account so that methodologies become more attractive to specific users and specific barriers reflected.

If these aspects are as decisive for energy efficiency as these authors show, then the EB's priority sector households would be more effectively supported if the EB improves the combination of different methodologies in PoA than with better cooperation with proponents of new methodologies.

If the development of AMS III.X and its usage are taken as an indicator of conditions in the households sector, two lessons to be learned in this sector are evident. First, ways to include the role of utilities, and second the avoidance of *in situ* measurements and the decision about the conservativeness of tests outside households. Methodologies for other appliances in households have to address these as well. Current utility regulations in Brazil define how utilities use subsidies in low-income households. It is not unavoidable to account for these regulations on a country by country basis. Many utilities use Least-cost Planning tools. Often those utilities using these tools are also those that invest most in Demand-side Management. Perhaps the most effective support the EB can give to the households sector is a tool that suggests how utilities' use their Least-cost Planning in a CDM methodology. Possibly this would have improved the negotiations between BSH and the utilities CEMIG, CPFL and Coelba. For renewables, the President's Proposal suggests guidance for feed-in tariffs in the additionality analysis (para 24), responding to the EB's recent difficulties of assessing wind projects in China. For the households sector, low-income household tariffs might also become necessary guidance and not only for additionality but for the eligibility of households.

Regarding *in situ* measurements and baselines, AMS III.X shows a pre-installation survey is sufficient to demonstrate a class of households – those that never buy a new refrigerator. For this class of households, there was no correlation between refrigerator age and efficiency and thus a group of variables such as technology penetration rates, end-of life and natural replacement rates, did not have to be included. This condition is specific to Brazil and other means to define a class of households (especially other than income) and other simplifications for determining the baseline can be effective in other countries.

A final suggestion to be stressed regarding sectors, as support for countries with less than 10 CDM projects, it might be effective to define households classes in such countries and specify baselines simplifications for these classes. The potential to reduce costs of monitoring in CDM is higher than via the suggestions in the President's Proposal and more effective than the prioritization of methodologies in the EB' annual report. Both the President's Proposal and the EB tend to seek means of sector support that is possible across all sectors and thereby fail to seek sector support that is feasible only in the household sector.

2.1.2 Contribution to Sustainable Development

The EB annual report's paragraph 28a is simply copied into the President's Proposal:

> 28. The Board further recommends that the CMP:
>
> (a) Encourage DNAs to publish the criteria they use in assessing the contribution of project activities to sustainable development;

No other recommendations regarding sustainability co-benefits are formulated and even this one is hardly realistic. The premise that DNAs must have the authority to define these is as strong as it was 10 years ago, and equally strong is the evidence that DNAs are politically too weak to do so. This should have been evident from the start, for example the IISD had undertaken an extensive indicator inventory programme for years that has once and for all shown that there are as many metrics as there are sustainability efforts. The exception is China because its DNA has produced preferences for CDM types that reflect Chinese development policy and a differentiated CER Tax but even these would not correspond to the intention from the EB cited above.

Many efforts to operationalize a sustainability metric are known and three will be briefly presented. Neither one of the three has gained much influence and no DNA has ever commented them. The three are the Gold Standard, the Suttor Sustainability Check-up and one from the Wuppertal Institute.

The Gold Standard Sustainability Screen weights 12 criteria between "+2" and "-2": Water quality, air quality, soil, other pollutants, biodiversity, employment quality, income to poor, access to services, human capacity, employment, trade, and technological capacity. A project qualifies for the Gold Standard when the sum of the 5 environmental criteria, for the 3 economic criteria and the 4 social criteria is

positive, when no criteria has a "-2" and the total of all 12 is positive. The variables for all criteria are defined case by case.

The Suttor Check-up uses the following 12 criteria (Suttor and Parreno 2007):
Participation, basic services, distribution of CER returns, capacity development, fossil fuels, water quality, local air quality, land resources, regional economy, micro economic efficiency, employment, technology transfer. For most criteria quantitative variables are defined for example created employment months per 1,000 CERs, viability with 4 €/CER, or change in respiratory disease. The check-up is therefore more transparent than the Gold Standard Sustainability Screen.

The Wuppertal Institute suggests also 12 criteria (Rudolph 2007) but one less on environment and one more for the social dimension:
Air quality, water quality and quantity, space for animal life, land use, distribution of CER return, participation, basic services, knowledge, property rights, macro economic stability, employment, and technology transfer. These are ranked "+5" to "-5" and quantitative thresholds proposed, combustion MW, water treatment types, income >1US$/day, number of employment, and so on. This metric shows in particular that quantitative parameters for all 12 criteria can be defined and many factors about the country context integrated, thereby a DNA can use such a metric across many different CDM project types.

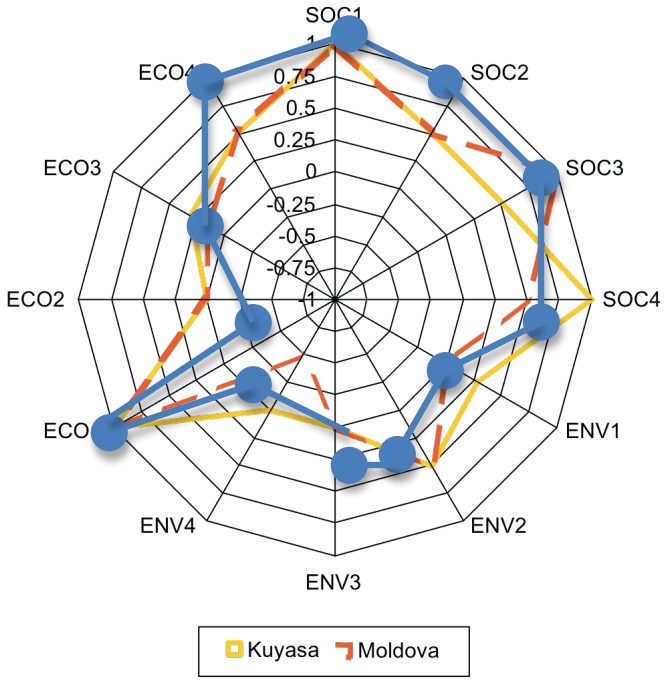
Each of these three metrics would improve CDM development work because the interaction between developers, DOEs, DNAs, and investors or buyers of certificates would improve. Developers could adapt the project designs and just as important, would know better what to expect from the DNA. Many trade-offs in project design are being hidden for fear of cost increases and delays. Undoubtedly by adopting one such metric, a DNA would address many of the concerns reflected in the KfW input to Cop15 and in the President's Proposal, facilitating transparency between the main CDM stakeholders.

Watson and Fankhauser (2009) reviewed a wide and representative sample of 409 PDDs for contributions to physical, natural and social capital. It is the widest available assessment. It concludes that sustainable development co-benefits appear in 67% of the CDM projects. Unfortunately they are not quantified[5]. "If it is agreed that no measurement process for SD is likely to be found, there should be an investment of efforts into alternative mechanisms for host countries to realise development benefits through CDM." (Watson and Fankhauser 2009: 18). In other words, they suggest that the current CDM process cannot be reformed to increase sustainability benefits without affecting the sovereignty of countries and therefore different means will be needed to allow countries to enhance the sustainability co-benefits. Their conclusion assumes that sustainability co-benefits can only be improved by differentiating the outcomes of CDM projects and if this is not feasible on the national level, different global rules are needed. This conclusion is not unavoidable because it excludes the possibility that methodologies can be shaped so that higher sustainability co-benefits must appear. AMS III.X assures that efficiency

[5] Otherwise the study confirms that industrial gas CDM have little co-benefits, small scale ones are similar to large scale ones in co-benefits, and unilateral CDM have less technology transfer components, as others have shown before.

gains are concentrated in low-income households and no national regulations or DNA practice is required.
Nussbaumer (2009) tested the sustainability impact of CDM with a different analysis. He selected a representative sample of Gold Standard CDM projects and projects in the World Bank's Community Development Carbon Fund and found that they do no "drastically outperform non-labelled ones. Also, the distinction between projects might very well be within the range of uncertainty intrinsic to such an assessment." (2009: 99). The figure below shows the amoeba graphs of two energy efficiency in households CDM projects, in yellow the Gold Standard, in red the CDCF one, as presented by Nussbaumer. Superimposed in blue, the results for a CDM project with AMS III.X. The criteria are those proposed by Suttor. AMS III.X brings superior results for SOC2 'Service Availability', lower for ECO02 'micro-economic efficiency' and higher ones for ECO4 'Technology Transfer'.

Figure 20:



Source: Nussbaumer 2009: 98

Most variables are similar for all three cases, underlining that CDM projects of the same type cannot be compared with the quantification proposed by Suttor. In the household sector, health and gender co-benefits require more differentiated variables and the economic criteria do not reflect the low-income context. AMS III.X seems to lead to similar sustainable development scores with the well known metrics.

Overall the substantial literature on CDM (over 200 studies according to Olsen 2007) suggests that sustainability co-benefits can not be reflected in the economic valuation of certificates and demand and supply factors for certificates continue to ignore co-benefits. DNA's as policy makers will not be able to substitute for this.

2.1.3 Technology Transfer

Technology transfer is possibly the most recurrent and the most elusive theme in climate policy and even longer so in development policy. Southern countries view technology transfer from a developmental perspective, advanced technologies should help to accelerate growth. Developed countries often follow a diffusion perspective, seeking to spread low-carbon technologies to reduce the impact of growth in the South. Both underestimate the difficulties, diffusion does not work without capabilities to re-design technology and diffusion is often undistinguishable from typical R&D, and developmental gains are not just access to patents or new technologies but acquiring capabilities to absorb technologies. From both sides, the ambition is higher than what the means offered could achieve.

For CDM projects, technology transfer benefits are substantial. The most comprehensive assessment, provided for the UNFCCC RIT, concludes "approximately 39% of the 2293 registered and proposed CDM projects claim some technology transfer. But these projects account for about 64% of the annual emission reductions….. Most (56%) 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, but those projects account for 39% of the emission reductions" (Seres, 2007: 21). These conclusions mirror much of the technology transfer literature in general. When only equipment is moved, the embodied knowledge does not stimulate further impact and when no unpacking skills exist, the dependence on technology imports becomes counterproductive. The unpacked knowledge increases inefficiencies. The overall impact of CDM regarding technology is not clear because it is not possible to distinguish in most cases whether the technology component increases local technological capacity or not. In each case of a sample of CDM projects, it would be necessary to find out whether individuals and firms engaged in the project increase their understanding of the content, whether the same content can be reproduced or also altered and improved.

The assessment by Seres above used the full spectrum of 2293 cases (end of 2007). De Coninck (2007) pursued the opposite approach, took only the 63 CDM projects registered in Jan 2006 but investigated the outcomes rather than only the PDDs. "In almost 60% of the projects, furthermore, we could confirm that new or improved technology was used….. In most of the projects, new or improved technologies were used, and in many, knowledge transfer and capacity building took place, although these numbers are uncertain…. It is remarkable that the allegation that CER-buying countries sponsor their own private sector through buying CERs only from projects that use national technology is not supported by the data above. The large buyers of CERs, such as the Netherlands, Japan and Italy are not the countries that export the highest value of technology to the host countries for CDM projects. It should also be noted that the US, has exported technology valued at around € 50 mio, around 10% of the total export value for CDM projects at the time", (De Coninck 2007: 16). De Coninck also concluded that there was a trend to more high-tec in CDM, especially in

the high volume CDM such as wind turbines, where CDM projects have stimulated large technology transfers to China and India.
Preceding Copenhagen's COP15, many voices stated progress on technology should be possible as part of the negotiations about finance (Global Climate Network 2009, and A Cosbey in IISD). Indeed the Bali Roadmap has moved technology to centre stage. While Copenhagen has created numerical targets for finance, there has been no suggestion about the suitable structure or tools to use these funds. The effectiveness of the GEF, the potential of TRIPS, and the outcome of CDM have not been compared or parts of these funds related to them.

Table 5

Knowledge sharing and coordination	1. Carbon Sequestration Leadership Forum (CSLF) and the International Platform on the Hydrogen Economy (IPHE) 2. Methane to Markets Partnership 3. Task sharing in International Energy Agency Implementing Agreements (IEA-IA) 4. Asia-Pacific Partnership on Clean Development and Climate (APP) 5. Energy Star bilateral agreements
RD&D	6. European Organization for Nuclear Research (CERN) 7. ITER fusion reactor 8. Cost sharing in International Energy Agency Implementing Agreements (IEA-IA) 9. The Solvent Refined Coal II Demonstration Project (SRC-II)
Technology transfer	10. Multilateral Fund under the Montreal Protocol 11. Global Environment Facility (GEF)
Technology mandates and incentives	12. International Convention for the Prevention of Pollution from Ships (MARPOL) 13. European Union Renewables Directive
Prospective TOAs	14. Carbon capture and storage technology mandate (Edmonds and Wise) 15. Zero-Emission Technology Treaty (ZETT) proposal 16. Barrett and Benedick proposals for combined technology R&D and standards

Source: De Coninck 2007: 14.

Each of the technology-oriented agreements in the above table has strength and weaknesses and there is no proposition which one would be more adequate for what technology type. Possibly many will be pursued in the near future. De Coninck and her colleagues both at ECN and at RFF refrain from commenting on these possible agreements based on their conclusions from the 63 cases analysed, probably because they feel that the empirical basis is too weak for this.

Chapter 7 of the 2010 World Development Report "Development and Climate Change" proposes risks and targets for each agreement type (WDR 2010: 294). "Technology transfer comprises the broad processes to support flows of information, know-how, experience, and equipment to government, enterprises, nonprofits, and research and educational institutions. It requires building national capacity to identify, understand, use, and replicate useful technology. …. Multilateral funding can support technology transfer in three ways: by subsidizing investments in

homegrown or foreign technologies in developing countries; by subsidizing the involvement of developing countries in the types of knowledge exchange, coordination, and cost-sharing agreements, and by supporting national knowledge infrastructure and private sectors" (WDR 2010: 303). The World Bank stresses the need to broaden technology transfer in order capture the systemic properties of technical change in general. Insights from the Schumpeterian economics school are highlighted wherever possible. The World Bank's proposals are hesitant because it leaves the policy lead to the UNFCCC. The Bank's own answer is its *Clean Technology Fund*, a 5.2 bn US$ multidonor initiative established in 2008.

For CDM and technology transfer, the World Bank's judgement is negative. Transfers of knowledge and equipment are seen as insufficient and while the CDM as such is the only effective market instrument to date, the incentives provided are too weak to foster the necessary transformation to reduce carbon intensities. The CDM's project approach structure and lack of leverage will always limit its contribution, according to the World Bank. These conclusions are well substantiated. One criticism should be addressed to the Bank, while it powerfully stressed the systemic nature of innovation and concludes many important lessons for technology transfer that has to be reflected in international agreements, it has not used the opportunity to study some CDM projects in detail and establish the strength of upstream and downstream linkages. For Foreign Direct Investment, the Bank musters a myriad of empirical cases useful to inform national policy, why not create an equally strong analytical basis to show which technologies in CDM have spillovers and learning externalities and which ones do not ?

The PPP of GTZ/BSH had two technology transfer aspects, the high efficiency refrigerator introduced a technology level that had not been available in Brazil before and the refrigerator recycling technology required that exists only in Europe. These two aspects also highlight the types of spillovers or linkages appearing frequently in CDM projects. All components of refrigerator technology existed in Brazil previously, the refrigerant Isobutane, the lubricant, the refrigerant circuit and the compressor. To achieve a efficiency gain from 24 kWh/d to 15 kWh/d, the totally different composition of these parts is necessary. Nobody will get access to the engineering knowledge that went into the R&D for this improvement, and BSH will protect it as much as possible. Nonetheless thousands of refrigerator repair shops in Brazil are getting their hands on them and will learn by reverse engineering how to repair this technology. For the refrigerator, the technology transfer consists of the unpacking of embodied knowledge and only secondarily will there be learning in the manufacturing plant where BSH produces these refrigerators. Part of this knowledge is proprietary with the manufacturer of the compressor and this company will not reveal its knowledge, neither to BSH nor to anyone in Brazil. More important than the transfer within BSH in Brazil, will be related learning by the competitors of BSH in Brazil who will certainly not leave this advance to BSH for long. These three aspects, learning in the maintenance workshops, by local competitors and in BSH Brazil should be typical of CDM projects of the energy demand side type.

The recycling technology is of a quite different technology transfer type. It involves large scale and complex engineering, equipment and operating know-how. The methodology AMS III.X includes the condition (eligibility criterion) that old refrigerators are recycled according to the WEEE-Forum standard, implying that old refrigerators are cut into small pieces under vacuum conditions so that the 90%

recovery of CFC is achieved. Neither the CDM methodology, nor any CDM project would directly cause this transfer, but both contribute to create the incentives for this to occur. The largest contribution to this transfer will not come from CDM but from the voluntary markets because the VCS (Voluntary Carbon Standard) created a scheme that credits CFCs and this will contribute the largest part of the cost of this recycling technology. The methodology AMS III.X, somewhat exaggeratingly so, claimed that WEEE-Forum standard would be the best basis to adopt so that recycling technologies involved in carbon trading compete based on recycling rates. This contributed to convince the VCS to demand the WEEE-Forum standard in its Update VCS 2007.1, the scheme that credits CFC destruction.

These two quite different forms of technology transfer, the refrigerator technology and the recycling technology, illustrate the technology co-benefits possible with CDM projects. Both of them have substantial multipliers, i.e. if successful, the emission reductions from technology transfer are higher than those directly created by the CDM project and the precise number of household refrigerators replaced. The technology transfer impact of CDM projects is best assessed at a sector level, for example, all CDM projects in a country regarding all types of refrigeration should be analysed together so that interaction between them are also captured. Such analysis would be necessary to come to a meaningful result for small-scale hydro, for bagasse boilers, etc., where CDM technology transfers have affected the sector as a whole. For refrigeration that is not possible yet, because there are no registered CDM projects for household refrigerators in operation. The technology impact of the PPP BSH/GTZ will only then be fully evident.

2.2 Comparison of AMS III.X with other methodologies (II.C, II.E, II.F, II.G, II.J) and other CDM projects for appliances

Excluding the recent CFL projects in India, only 13 CDM Projects with AMS II.C are registered since the beginning. The methodology is now in its 13th version.

Table 6:

Kuyasa	Dec 2004	Solar water and insulation systems
ITC Bhadrachalam	Aug 2005	Pumps and compressors in paper plant
ITC Tribeni	Aug 2005	Waste heat in paper plant
Vadodara	Nov 2005	Dryer system in soda plant
Tata Chemicals	Nov 2005	Steam system soda plant
GMR Industries	Apr 2006	
Compressed air demand	Feb 2007	Car component manufacturing
Hindustan Lever	Apr 2007	Mixer in soap plant
Tata at Haldia	Sept 2007	Motors and lights in soda plant
Compressed air Mexico	Nov 2007	Car component manufacturing
Sutrapada	Apr 2008	Chiller and pumps in textiles plant
Jubilant Organosys	Oct 2008	Steam in pharmaceuticals plant
Bucheon Fawoo	Jan 2009	7,668 CFLs in factory

AMS II.C is used only for isolated energy efficiency projects in industry, and with few exceptions only in India. This methodology has not created any significant CDM development since most of the registered ones are commercially not viable and have been pursued more out of CSR than for emission reduction investments. The 13 revisions of II.C have not improved the usability significantly. This warrants the conclusion that this methodology can not be used nor can it be improved. Its orientation from the start was flawed, demand-side energy efficiency can not be captured with a general tool for many technologies and appliances. The well documented obstacles, the *long tails, split incentives, retrofit or new investment* are responsible for it.

Three CDM projects with AMS II.E are registered, while six more are at validation for a long time (more than 12 months), all in India. AMS II.E is in its 10th version. Another major application was for Pao de Acucar, a Brazilian supermarket chain that repeatedly failed to get PDDs with II.E approved. The Pao failure and that the Moldova project has not yet been issued CERs, contributed to the slow application.

Table 7:

Moldova Biomass	Sept 2005	heating system, incl I.C and III.B, CDCF financed
ITC Hotels	Aug 2006	HVAC
Technopolis	May 2007	HVAC in office building, Phoenix software Ltd.

AMS II.F has only one registered CDM project, two were rejected (in Argentina). Caeté used a large methodology first but then decided to not export electricity to the grid and use all electricity within the sugar plantation, thereby making it a fuel-switch only project.

Table 8:

Caeté Mills	Jul 2006	Bagasse cogeneration for irrigation

AMS II.G has one registered project and two awaiting registration.

Table 9:

Fuel Wood Stoves for Nigeria	Nov 2008	
Santa Maria Brick Kiln	Oct 2009	
Cooking Stoves in Foothills	Jan 2010	

The only appliance with substantial investments are lightbulb CDM and with 9,684,000 CFLs installed in two years worldwide (not counting the PoAs), this underlines that the usability of methodologies is really the fundamental factor behind it. The initial impulse came from the manufacturer Osram investing in CDM methodology development for lightbulbs in Ghana, approved as AM0046 by EB29 in February 2007. This large scale methodology is too expensive to use but its creation clarified the monitoring variables so that with the outcome of AM0046, the application of II.C became possible and Osram was again the driving force behind it. In India, CFL manufacturers pursue competing CDM projects with II.C, whereas competing CDM developers uses II.J all for the same CFL lightbulbs. II.J was the first methodology for a household appliance. Most CDM projects are in two states of India and are initiated by a foreign CDM developer, EDF Trading, and national CDM developers. CFL CDM with II.J are in the following table.

Table 10:

Rwanda	Nov 2008	800,000 CFL
Orissa Aska Div	Jul 2009	163,000 CFL
Uttar Pradesh Varanasi	Jul 2009	360,000 CFL
Orissa Baripada	Jul 2009	213,737 CFL
Orissa Nuapada	Jul 2009	162,000 CFL
Uttar Pradesh Lucknow	Jul 2009	379,200 CFL
Orissa Bhadrak	Jul 2009	332,522 CFL
Orissa Ganjam	Jul 2009	121,000 CFL
Orissa Bolangir	Jul 2009	153,000 CFL
Orissa Bargarh	Jul 2009	198,000 CFL
Orissa Bhanjanagar	Jul 2009	199,166 CFL
KDHP Kerala	Sept 2009	72,000 CFL
Railways residential Northern	Oct 2009	660,000 CFL
Qiangling China	Nov 2009	1,000,000 CFL
Railways residential Western	Dec 2009	625,992 CFL
Railways residential Southern	Dec 2009	569,688 CFL
Railways residential Eastern	Dec 2009	629,667 CFL
Green Village Maharashtra	Jan 2009	80,000 PV lamps

The choice between II.C and II.J changes because the monitoring rules for II.J are subject to contesting interpretations. The following table shows those CFL CDM with II.C, and these use either Osram or Philips lightbulbs (the last one is the first outside India, in Brazil). These manufacturers have preferred II.C because they gain more

certificates (up to 60%) with elaborate monitoring taking advantage of the longer lifetime of their CFLs (15,000 hrs) as compared to those manufactured in India and China (< 6,000 hrs). The first one appeared in August 2007 because in February AM0046 was approved and it took a few months to apply the insights gained there.

Table 11:

Visakhapatnam	Aug 2007	580,000 CFLs
Yamunanagar	Aug 2007	630,000 CFLs
Kapada Circle	Jan 2008	720,000 CFLs
Chhattisgarh	Apr 2008	484,000 CFLs
Pune	Aug 2008	500,000 CFLs
Mumbai	May 2009	36,550 Street lights
AES Eletropaulo	May 2009	130,915 CFLs in school

The competition with II.C and with II.J will not last for long in particular when one of them is easier to use for Programme of Activities (PoA).

In India, the Bureau of Energy Efficiency (BEE) has created an India-wide PoA for CFLs, that obliges investors, manufacturers and utilities to agree to tri-partite contracts approved by BEE. The above CDM projects with II.C and II.J are also attempts by manufacturers and by investors to escape these BEE supervised contracts. BEE's choice of II.J was a compromise that reduced the original policy in the PoA design because BEE intended to provide the monitoring as a service to the utilities, but with II.J the monitoring is less relevant. BEE developed a bulky monitoring device, transmitting data via SMS messages, that added monitoring uncertainty because households change their use of lightbulbs because of this monitoring device. This monitoring device is a technical device embodying BEE intentions of binding state utility companies into the PoA. One Indian utility has reverted to AM0046 in a CFL project submitted in January 2010, accepting high monitoring costs.

Overall, the use and continued modification of II.C and II.J is influenced by Indian energy policy between the federal and state governments, by competition between manufacturers and between CDM investors. BEE is introducing a CFL lightbulb testing standard and this might improve the transparency of this competition. While all five entities involved, BEE, state government, utilities, CDM investors and manufacturers gain from replacing those bulbs most in use in households with CFL lightbulbs lasting as long as possible, the operational variables such as selection of households, mode of distribution, monitoring, invite these entities to pursue competing solutions. The influence of the methodologies is one of the most unpredictable factors in this competition.

2.3 Importance of Suppressed Demand, Applicability, Potential, Specific cost and Usefulness

The President's Proposal for COP15, paragraph 35, requested the EB to work on suppressed demand, maintaining the wording as used eight years ago in the Marrakesh Accord.

> 35. *Encourages* the Executive Board to further explore the possibility of including in baseline and monitoring methodologies, as appropriate, a scenario where future anthropogenic emissions by sources are projected to rise above current levels due to specific circumstances of the host Party;

Suppressed demand in baselines hold much potential to expand sustainable development benefits and define methodologies adequate in low-income contexts, certainly even more so in the countries currently underrepresented in CDM. The Proposal to COP 15 could have stressed this. Suppressed demand can be a summary term effective to bind the climate mitigation agenda to the poverty agenda. The EB could use this clause from the Marrakesh Accord as a mandate to give preferential attention to CDM projects reducing energy intensity of growth in low-income populations. Some have called this basic needs CDM methodologies.

While the suppressed demand issue is evident since Marrakesh, no CDM project or methodology since has been used to clarify it. The Kuyasa project has been widely documented since it was registered in August 2005. CFL lightbulbs, solar water heaters and roof insulations were installed in 2,300 old houses and 4,000 to be build houses. Insulation is a special case and has some similarities with household refrigeration. Insulation reduces energy needed, as does the higher refrigerator efficiency. While the room temperature required is the same, the new refrigerator allows household to store food that was not stored before so the service changes in quality. The impact assessment for Kuyasa revealed that all three energy forms, space heating, water heating and lighting were suppressed and remain so after the installations.

http://cdm.unfccc.int/UserManagement/FileStorage/FS_123598248

The rebound and the remaining suppressed demand were not quantified because households have multiple uses and fuels. In some months, electric geysers are used when the solar water heaters are not sufficient or kerosene is used for heating and cooking. Quantifying the suppressed demand would require larger samples and monitoring effort.

A typology of suppressed demand could reflect that suppressed demand exists in heating in certain countries in certain household income bands, other suppressed demand in water heating in other income bands. Winkler and Thorne (2002) distinguished suppressed demand that accrues to the investor from suppressed demand that should accrue to the country for the South African case. Instead a typology of suppressed demand could define different reasons of the user to suppress, lack of cash, lack of capital to buy the respective appliance (or ceiling insulation), danger of stealing electricity, prestige value of the service and others. A

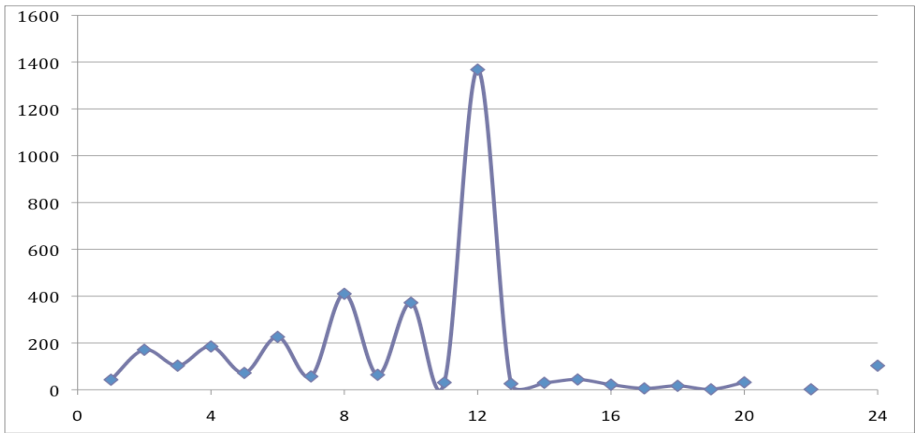
typology of suppressed demand could be used to choose eligibility criteria for CDM participation and as a basis for designing user surveys to inform baseline choices.

The Kuyasa project was planned to be expanded to 10,000 new houses in the same township of Cape Town. Southsouthnorth submitted three versions for solar hot water CDM methodologies, NM0308, NM0298 and NM0263, that were rejected. Insufficient analysis of suppressed demand was one reason because the Meth Panel did not agree to the general assumption that this was always the case. An approximation would need to be included in the monitoring. The modelling software for the new methodology for solar water heaters is the same as the software used for the Kuyasa project (which applied AMS I.C for the water heaters). To specify suppressed demand, baseline assumptions must be restricted and while the Meth Panel requested this, the proponents sought to keep the methodology as widely applicable as possible. Perhaps, interpreting the registration of the Kuyasa project to signal that suppressed demand in efficiency and in supply would be equally acceptable was too strong. Suppressed demand from poverty and from lack of public services is not the same. The interaction between Southsouthnorth and the Meth Panel did not reach these questions.

As discussed in chapter 1.7, AMS III.X implies suppressed demand is accountable but does not require to quantify it. Coelba has collected data from 3,378 households in Salvador, asking how long the refrigerators are typically switched off but without measuring this. The following graphic shows the distribution of the answers. On average 9.82 hrs per day the refrigerators were witched off. When the refrigerators achieve stable operations, then 41% of the baseline was suppressed, measurable in kWhs and this is only one part of the suppressed demand. This level of suppressed demand is high but also quite typical. Converted into contribution to refrigerator cost from CDM income, the suppression could plausibly supply 10 % of the cost of a new energy efficient refrigerator.

The graph shows the number of hours switched off per day, versus the number of households doing so, out of the total of 3,378 households.

Figure 21:



The peak at 12h is reporting bias but the variation to the left of it indicates that households know the relation between hours switched off and the bill level at the end of the months. The same distribution appears when the responses are arranged for

number of days per months when the switching off has to occur, between 200 and 400 households stated that switching off 4 to 8 nights per months brings them the bill level the can afford.

Suppressed demand for household refrigeration seems to occur in two types. The need to suppress from the inability to buy an energy efficient refrigerator, the larger part and distinct from the need to suppress the storage of food because the monthly bill would be too high. These two types of suppression can be analytically separated because one corresponds to affordability of a major expense, the other to recurrent small bills. Regular income in Favelas is rare and the recurrent bill is a stronger constraint for many. Solar hot water is perhaps closer to household refrigeration than lighting or space heating.

Another means to establish the degree of correspondence of suppressed demand for different appliances is to analyse the distribution of these appliances in relation to income or housing conditions. If two appliances are in use in similar households, then they could contain the same suppressed demand. In Rio de Janeiro, the utility company Light produced a detailed survey of appliances in 10 different Favelas in 2007 (already cited in Figure 2, page 6). It is the only survey where refrigerator age was reported together with household income level. The following table shows the results, in essence the same result as the much larger survey by PROCEL described in Chapter 1.2.1. The data is shown here to illustrate the following factor analysis.

Table 12:

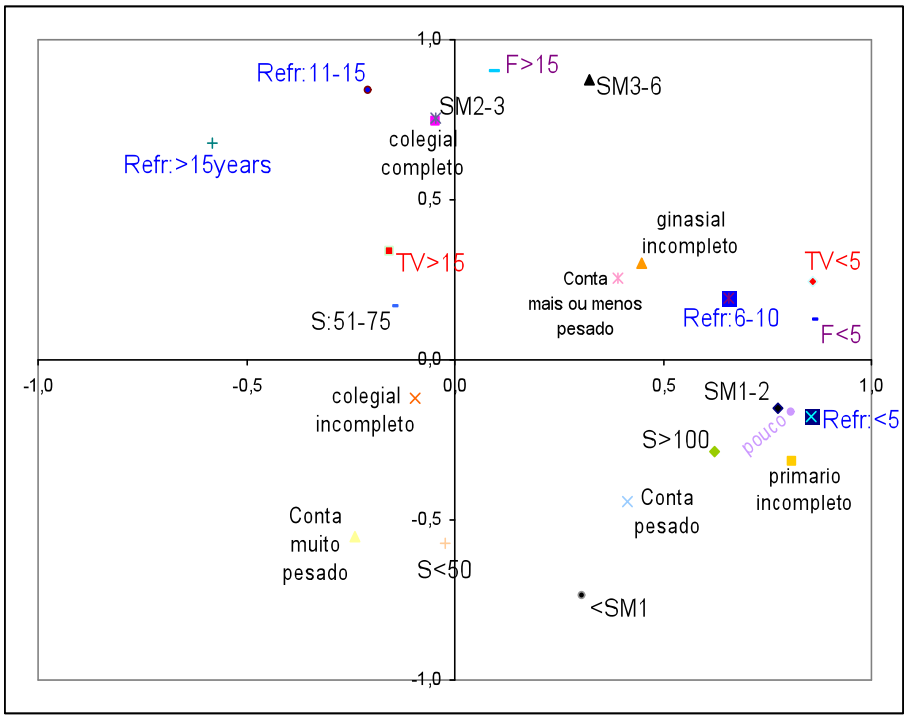
	Percentage of HH income				**Percentage refrigerator age**			
	<SM1	<SM2	<SM3	<SM6	0-5 yrs	6-10 yr	11-15	> 15
Caju	12	28	36	12	54	22	12	9
Jardim Ocident.	30	27	9	1	51	31	9	9
Lixao	28	22	11	5	44	15	7	1
Mangueira	25	11	45	16	50	28	12	8
Mata Machado	15	23	25	21	47	28	11	9
Parque 2 Irmaos	33	31	21	6	59	28	7	4
Parque Mare	37	30	21	7	58	32	8	2
Vidigal	19	17	36	22	48	34	8	7
Vila Brasil	24	32	28	15	40	26	13	12
Vila Moretti	42	13	39	5	46	30	11	13

The variation of income is typical for young Favelas such as Vila Moretti versus old Favelas such as Mata Machado. Refrigerator age variation is the same. The age data was reported for freezers and for TVs. Factor analysis is adequat for large samples, where the number of cases is ten- or hundred-fold that of the number of variables. Nonetheless 10 Favelas is already a sufficient number of cases. The figure below shows the results. All types of factor rotations lead to the same results and the Principle Component Analysis with Varimax rotation (software SPSS 15) is presented.

The results are coherent and the interpretation of the axis is straightforward. On the bottom, there is perceived electricity bill “muito pesado”, and house surface S<50m^2

as well as income <SM1, whereas on top there is SM3-6, so the vertical axis reflects the financial situation. Income below SM1 is certainly related to small houses and to the highest perceived importance of the monthly electricity bill. The socio-economic difference between SM1 and SM6 is large, often reflecting precarious situations versus quite stable lifestyles. "Colegial completo" is also well aligned with higher incomes.

Figure 22:



The horizontal axis shows a striking opposition between refrigerator age >15 years to the left and refrigerator age <5 years to the right. This opposition confirms the comparison of the average variables, that the refrigerator age expresses quite different sorts of causes than the income levels. Neither income, nor education nor house size is distributed along the vertical axis and only "conta pouco pesado" is close to refrigerator age <5 years (the label is rotated because the data points are close). There is the obvious explanation that the new refrigerator indeed has a lower electricity bill. The appliance newness is likely to reflect similar causes as Refr:<5, TV<5 and F<5 are close. Whereas high appliance age is dissimilar since Ref:>15, TV>15 and F>15 are different.

Such a factor analysis should be adequate to capture the variation of heating fuels used. For the Kuyasa case, it could provide a household typology where fuel wood, kerosene and electric heaters are used and patterns of appliance usage certainly imply similar and dissimilar types of suppressed demand. In response to the encouragement from the President's Proposal (para 35), a well documented case of suppressed demand quantification can stimulate CDM methodology development work.

2.4 Initial dynamic of Programme of Activities and application of III.X, II.C, II.J and II.G

Regulations for Programme of Activities have been considered since 2005. The first one was submitted in January 2008. The first PoA was registered in July 2009 after EB47 had taken a number of decisions for PoA, although not all and not in final form. The crucial advance through PoA is that it can contain an unlimited number of components, so-called CPA, added at any point in time during the crediting period without any new approval. This gives the CDM proponent the ability to add new units in new plants, new cities, regions, even other countries as it suits him without new administrative costs. The DOE verifies those CPA in operation in any year for its monitoring report.

The President's Proposal only repeated the need for reducing the liability for erroneous inclusion of a CPA (paragraph 36), asking the EB to further "clarify the situation". The EB wanted DOEs to be liable for erroneous inclusion but later on found out that this liability was too strong, so that DOEs refused to perform their role, and the EB then reduce this liability significantly. Several other aspects of PoA are also not finalized yet and the regulations remain uncertain at least for the following aspects:

use of several methodologies in CPAs
changes required when methodologies change
sampling of CPAs in monitoring
difference in the additionality test at PoA or CPA level
differences in stakeholder consultations at PoA or CPA level

The ability to use several methodologies would provide a substantial boost if CPAs with different technologies can be combined in the same PoA. This decision rests on the judgement of the quality of work by DOEs. Another important aspect is the additionality when "the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation", opening many new opportunities since policy per se is excluded. For household appliances another big boost would be the exception of additionality tests when each subsystem (appliance) is less than 1% of the SSC threshold.

Forty PoA CDM projects have been submitted until the end of 2009, two are registered so far, Cuidemos Mexico and Sadia Brazil. These forty indicate two different PoA categories. First those from CDM investors that are commercially motivated: Cuidemos, Sadia, Hidromasca, SWH in South Vietnam, Thermax (boilers and chillers), Cooking Stoves Bangladesh, Wonderbag in South Africa and others. Some of them are pursued by managing entities whose main interest is the sale of equipment such as biomass boilers or solar water systems, others are CDM accumulating funds or intermediaries. Sadia and SWH in South Africa have in common that the managing entity seeks to provide an additional service in the form of the monitoring. In these cases one condition for inclusion of the CPA is typically the acceptance of the monitoring instrumentation. The second class of these PoAs

are those pursued by the World Bank and by national governments: MSW Uganda, CFL Senegal, SWH Tunisia, SWH Bangladesh, Conavi Mexico, Taxi fleet Egypt, Biogas Hunan China, Livestock waste Thailand, and others. Some of these might turn out to be commercially viable. Often the monitoring is assured by third parties and uses different sampling approaches also to establish which ones are the easiest or cheapest. The following table lists the PoA in chronological order.

Table 13:

Cuidemos Mexico	II.C	
Sadia Brazil	III.D	
MSW Uganda	III.D	
CFL Senegal	II.C	
Hidromasca Honduras	I.D	
SWH Tunesia	I.C	
Hydraulic Rams Zhejiang China	I.B	
BEE Bachat Lamp India	II.J	
SWH South of Vietnam	I.C	
Biomass Heat Thermax India	I.C	Small steam boilers
Cooking stoves Bangladesh	II.G	
Solar home systems Bangladesh	I.C	
SWH South Africa	I.C	
Coffee refrigeration South Korea	II.C	
Conavi Mexico	III.AE	
Wonderbag South Africa	II.C	
Taxi fleet Egypt	III.C	
Biogas Henan Shangqiu China	I.C	
Biogas Henan Zhoukou China	I.C	
Transformer replacement China	II.A	
Absorption chillers Thermax India	II.D	
Electricity grid Yemen	II.A	
Livestock waste Thailand	III.D	
Composting Indonesia	III.F	
Biogas Nepal	I.E	
KIPRAH waste mgmt Indonesia	III.F	
Small hydro power Indonesia	I.D	
Small hydro power Vietnam	ACM0002	
Reforestation Nicaragua	AR-AM0004	
Livestock waste Philippines	III.D	
Chiller India	II.C	
Transformers Punjab India	II.A	
CFL Bangladesh	II.J	
SWH India	I.C	
Onil Stoves Mexico	II.G	
Onil Stoves Guatemala	II.G	
Small hydro power Vietnam	ACM0002	
MSW Rajasthan India	III.F	
Biogas Vietnam	I.C	
Biogas Chongqing China	III.R	

Two thirds of them appeared on the UNFCCC website in the last days of 2009 because EB47 (report para 72) had set this only as deadline to include CPAs (to be replaced subsequently) started during 2009. The events at COP15 and the events in the US Congress also played a role in this rush. Some of them will fail validation but

their proponents decided that it was worth to take the risk as it allows them to start implementation immediately. This rush is thus also an indication at the urge with which these CDM proponents want to experiment with the PoA format because it allows them to undertake projects otherwise impossible. Getting important experiments under way allows them to feed in the results while the PoA regulations are still changing.

So far only small hydropower projects in Vietnam are subject to competing PoAs, one from the World Bank, the other from South Pole Carbon. Such PoAs compete on the financial terms they offer to CPAs because of the nature of small hydro installations. Solar water heaters can be such another such case and the SWH PoA in South Africa could be covering one region but suppliers of water heaters could also compete on PoA designs because one with a credible sampling system of many solar water systems can offer better financial conditions than a supplies without a sampling system. DNAs might see sampling systems as a means to shape PoA for a specific influence on solar water market development in a country. The methodology I.C is also a candidate for modification in light of PoA competition.

Other technologies are prone to PoA developers seeking to pre-empt potential competitors, for example biogas combustion (Sadia combines the flare with the monitoring). In the CFL case, it is possible the PoA from BEE does set a precedent. The monitoring instrument to use II.C for higher CER credits might fail to bring many CPAs in BEE's PoA although the real reason might be divergent interests between BEE and the Indian utilities. Strikingly neither Osram nor Philips have seized the opportunity to produce a monitoring instrument (microchip based) that assures them a monitoring advantage. Their willingness to cooperate with BEE played a role.

If PoAs can compete or not depends first of all on the number of participants. Refrigerators, like lightbulbs, are not likely to allow for PoA competition because the number of producers is very small whereas number of users is very large. For refrigerators this is even less likely because of the refrigerator recycling and because the replacement of old refrigerators always depends on the availability of subsidies. With the WEEE criterion it is only possible to operate a PoA when the old refrigerators are recycled in a large scale plant and there are not more than one in most countries. Competition among PoAs can exist only when the managing entities have similar access to this plant. It might be a subject of PoA guidance or DNA measures to assure that PoAs can compete, for refrigerators this depends on the recycling, for lightbulbs it could turn out to depend on monitoring instruments. In both cases competing PoAs could be important to compare different distribution channels, for instance via utility companies or via retail channels.

CDM types with many possible producers are for examples cooking stoves and the methodology II.G and in these types PoA competition is quite likely. The evolving III.AE, awaiting top-down revision in the SSC WG during 2010, could be in the same situation because large numbers of producers are possible.

Chapter 1.12 explains how the PPP GTZ/BSH did not find an opportunity to submit a refrigerator PoA to the UNFCCC and that different geographic scopes for PoA were written up as PoA-DDs and left for different utilities to pursue further.

2.5 Utility Demand-Side Management and household appliances

Demand-side Management (DSM), which can generate "negawatts" in lieu of generation capacity to meet the demand for energy, can be encouraged by and has been successful under some regulatory regimes[6]. The term was coined in the 1970s after the 1973 energy crisis. In some circumstances, this requires habit changes on the part of businesses and individuals – such as using appliances during off-peak hours, or changing shifts for energy-intensive operations so that demand does not outstrip supply. For instance, such DSM measures are currently used out of necessity by South African Eskom to reduce the daily power outages due to rapid growth in energy demand having overtaken supply. Another example involving more structured management is Stadtwerke Hannover and Freiburg's use of DSM in their Integrated Resource Planning as a long-range option for the past 10 years.

Rather than ask customers to change habits, they have been carefully crafting subsidies for efficient refrigerators, light bulbs, insulation and other energy savers that allow consumers to enjoy similar or even better services while consuming less energy. This leads to happier customers, lower energy bills, more easily managed power demands and reduced impacts on the environment. In other words, Demand Side Management can bring significant benefits to all stakeholders.

Carbon markets have the potential to lead to a new wave of utility DSM and other end-use efficiency activities. The first CDM projects of the DSM type are those that substitute CFLs for incandescent light bulbs, typically providing the same lumen output using 75% less electricity. In Mexico, India and Senegal the documents for around 435 million light bulbs, have already requested registration. Brazil began some of its first DSM pilots after the power outages in 2001. The projects included a combination of awareness-raising and light bulb and refrigerator replacement. End-users are provided with efficient CFL bulbs free of charge (or at a reduced price) in exchange for the inefficient incandescent bulbs. The programmes are paid for with CDM revenues. Thus the entity that implements the program covers the bulk of the up-front capital cost of the more expensive CFLs and is paid back over the lifetime of the CFLs, as CERs are generated and sold, eliminating the up-front capital cost barrier to the end-user. Households have lower energy bills, the market for CFLs is stimulated, utilities can better manage peak demand (without the need to build additional power plants just to satisfy peak demand) and increase grid reliability, local pollutants and greenhouse gas emissions are reduced, and the national economy of energy importing countries is strengthened by conserving scarce foreign exchange.

DSM is one more field that requires urgent action from the EB because EB22 decided that national and sectoral policies giving advantage to less emissions intensive technologies when implemented after 11 November 2001 are excluded for additionality. That was necessary to eliminate the perverse incentives for countries to not implemented energy savings policy so that the CDM income potential is not affected. This date is somewhat artificial. Instead it would be more effective to regulate the additionality of CDM for DSM above certain level of DSM cost. And countries that have never used DSM should be allowed to engage in all DSM under CDM. If the EB does not act, then countries might delay DSM also because of

[6] Arquit Niederberger, 2008, pp. 127-145, and Arquit Niederberger, 2007.

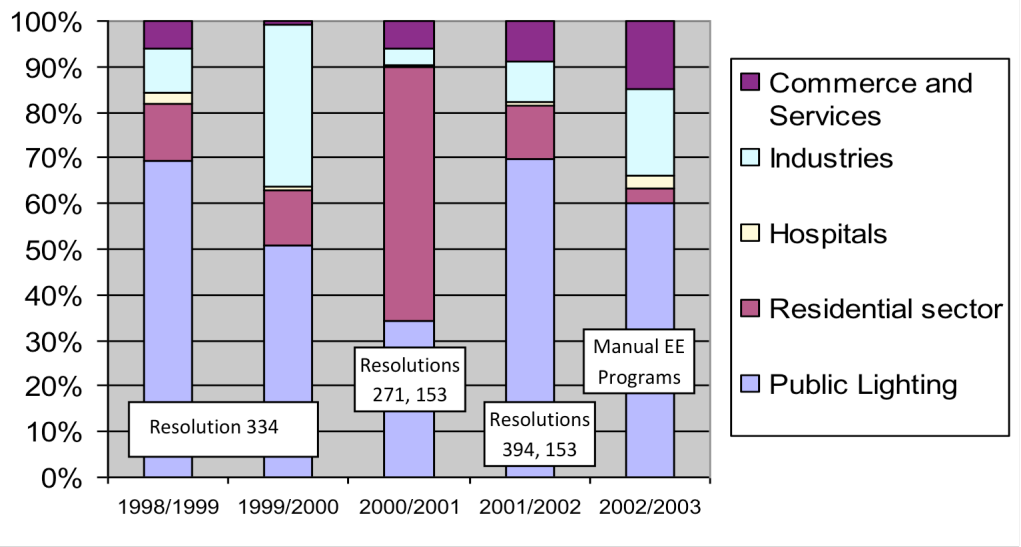
perceived ambiguity. The IEA's DSM workgroup (www.iea.dsm.org) Task XVIII is currently preparing an inventory of DSM programmes that are or should be made eligible for CDM. At the height of expansion in DSM, thousands of DSM programmes operated in the USA alone and their results allow a precise definition of the historic costs of avoided kWh and the basis for an EB decision is clear.

In the Brazilian case this problem did not occur only because the Brazilian utility companies have been partially privatised and it has become standard practice that utilities spend their funds from the ANEEL wirecharge irrespective of all cost concerns. The respective demonstration has been produced in the PPP BSH/GTZ in a study by Prof. G Jannuzzi, a leading specialist on DSM in Brazil:

http://cdm.unfccc.int/UserManagement/FileStorage/Z1GDMJ3C4N8H6G3ANP7TWRD9106ORT

This study can be used by all Brazilian utility companies as justification of the additionality of programmes pay for from ANEEL funds. It would be an opportunistic benefitting of the aborted privatisation, but it would certainly be an effective way to force the EB into action. The justification for the additionality is simply the demonstration that ANEEL fund usage was arbitrary and therefore independent of the real cost situation. Prof. Jannuzzi illustrated this with the following graphic:

Figure 23:



Source: Jannuzzi 2008, weboage above

The reason why utilities preferred to spend these funds for public lighting was that they can simply implement the energy saving as their clients (municipalities) do not act on cost/benefit considerations either. Certainly the same amount of funds would have created much higher energy savings in low-income communities instead of public lighting but this is disregarded out of convenience.

The additional income from CDM for all these DSM programmes would not have been convincing for the accountants in these utilities either, but they would have brought additional reputational benefits and possibly useful business links to European utility companies that need to buy CERs for their own trading under the EU ETS.

Until the UNFCCC finally recognises the gaping hole in its CDM regulations, studies such as this one from Prof. Jannuzzi provide an effective stimulation of DSM.

2.6 Comparison with other ODA supported methodologies

Michaelowa (2004, 2007 and 2009) provides an overview of ODA funded support work on CDM and comes to 30 mio US$ already before 2004. Denmark, France, Germany, Japan, Netherlands and the UK are the most active bilateral funders, plus the EU, ADB, IADB and World Bank from the multilateral side. The bilateral funds focused the creation of Designated National Authorities (DNAs) and 34 countries received support the DNA. After 2006, support for DNAs declined and other forms of CDM support appeared. The World Bank started "Carbon Finance Assistance" for Botswana, Cambodia, Mozambique and Uganda. The UK chose Pilot PoA preparations in South Africa and France started CASCADE focusing agriculture and forestry. In 2007 the Nairobi Framework was initiated as a collaboration between UNEP, UNDP, AfDB and the World Bank. GTZ's CAPP programme chose Ghana, India, Indonesia, South Africa and Tunisia. The Green CDM Facility for Africa funded by Denmark (3 mio US$) targeted Benin, Burkina Faso, Ghana, Mali, Niger and Zambia. There is no underlying theory that let these efforts support particular CDM projects or project developers. In 2007, Michaelowa counted 65 different CDM project development programmes in ODA. Many of these did not lead to registered CDM projects, however, that would be a poor indicator since the ODA efforts were linked to national players and interests. Directly registered CDM projects are not a sufficient indicator for impact.

Most ODA funds have been used to create demand for certificates certainly because it was felt that a market instrument is best supported in that manner. The Gold Standard stands out as carbon market segment that has received much financial support from ODA. Leaving aside the World Bank because one cannot know what motivated individual methodologies it created, there are only four methodologies that were explicitly created with ODA funds. Danida, the Danish aid agency, was first. Parallel to the PPP GTZ/BSH, Swiss ODA funded two methodologies for refrigerator production (AM0070 and AM0071) via support from UNIDO to two Indian refrigerator manufacturers. In true donor tradition, the Swiss ODA and GTZ did not coordinate their methodology work, but this would have been difficult since the Swiss funds passed through UNIDO and a coordination GTZ – UNIDO would have been a major hazard due to even for UN standards extreme levels of management in UNIDO.

Danida first submitted a methodology for district heating in June 2003 as NM0058. ABB Denmark was the turn-key contractor to rebuild the district heating system Houma, Shanxi Province China with a budget of 15 mio US$. The first submission was deficient because baseline and project scenarios were not completely described and the methodology proposed still had context dependent variables in them. After rejection in November 2004, it revised the proposed methodology and resubmitted it as NM96, which was again rejected by the EB in July 2005. DANIDA hired another consulting agency to revise the new methodology and resubmitted it for the third time as NM181 in June 2007, finally approved in September and became AM0058. The baseline in NM0058 was 1.5 mio tCO_2e, that in the approved version 2.0 mio tCO_2e, while the project scenario increased from 508,000 to 1.4 mio tCO_2e, illustrating how much the boundary assumptions had shifted. It has taken four years to bring the methodology to the final form because gradually the focus changed. First the calculation centred around the precision of the heat losses in the district heating

system, much of which was later excluded because this precision did not add to the conservativeness. Instead the components of the baseline scenarios were step by step further specified. Some of this was only possible because the consolidated methodologies ACM0009 and ACM0011 were developed in parallel.

Eleven CDM projects have been submitted using AM0058, making this an above average successful one. The boundary and scenario problems are intrinsic to district heating and cogeneration. At present, other cogeneration methodologies are still being considered because several different methodologies are needed to cover the spectrum of applications. Certainly district heating systems in China represent such a large potential that this choice of application to pursue a district heating methodology was quite appropriate. It should be stressed most forcefully that the hesitation of power plant technology providers (Siemens, ABB, Alsthom, General Electric etc.) to work on CDM leaves it to governmental agencies to undertake this work.

Two refrigerator production methodologies were submitted in September 2007 (9 months before the PPP GTZ/BSH submitted one), one for Godrej, the other for Videocon, the two largest producers in India. Both were approved one year later in September 2008. The outstanding property of these is the use of average efficiencies of all refrigerators available nationally. A “double benchmark” of those produced by the particular producers and the second on all producers. This approach is new and the objective is to create incentives for improvements of refrigerator technology. This objective does not require using the most advanced producers but the double benchmark approach makes it advantageous. This association with the producers forced the submission of two, one for producers who had already shifted to Isobutane as refrigerant, to other for those still using HFC-134a. Both methodologies are rather conservative in the choice of emission reductions included by using easy to monitor variables.

Judging these caused some tension within the EB (see Chapter 1.11 p.57). Indeed it is a difficult decision whether the emission reduction is achieved in the manufacturing plant or in the household using the refrigerator produced. Typically for the EB it chose to rest as close as possible to the Marrakesh Accord and decided to avoid discriminating in either direction. Neither Godrej, nor Videocon have used the approved methodologies to submit CDM projects for validation because they encountered difficulties to gather all market data required to do so. At present, requests for revisions are developed that would render these methodologies applicable.

A significant comparison of AM0070/71 and AMS III.X is their impact on competition between manufacturers. AM0070 was defined for use by manufacturers with Isobutane as refrigerant and AM0071 for manufacturers with HFC-134a (see Table 3, p.31). Whereas AMS III.X was designed explicitly to give the former commercial advantage over the latter (by including HFC-134a emissions in the boundary). This is a significant element of the GTZ/BSH strategy in the PPP that relates fundamentally to the Montreal Protocol. The GHG impact of Isobutane refrigerators is lower by a factor of 500 compared to HFC-134a refrigerators. AM0070/71 ignore this difference and send an overall ambivalent policy signal, to bring carbon finance into technology progress, but in way that partially contradicts it by crediting Videocon for doing something that Godrej has already done years before. This is a typical

additionality problem when technology changes are concerned. AM0070/71 has been an opportunity to address this additionality problem and suggest to the EB to qualify the role of competition between leading manufacturers and their respective baseline, that should, in principle, be the same for both of them.

In total only four of 150 existing methodologies were funded with ODA support, AM0058, AM0070, AM0071 and AMS III.X, certainly to small a basis for any qualification of ODA funding[7]. Only one of the four, III.X, concerns a project type that has been the subject of much ODA efforts in the past, low-income households. Using Michaelowa's inventory of ODA funded capacity development, methodology support was more successful than DNA support for project development. Such comparisons are methodologically unsound and analytically of little insight. A better assessment should be to relate the four to the deficits according to EB, see Figures 19 and 20. Can ODA support cross-cutting tools, methodologies in households or improve the usability of unused methodologies, in ways that commercial CDM developers can not ? If the answer is positive, then qualifying this possibility can include judgement what influence the ODA supported tools or methodologies have on the supply and demand for CERs in general.

2.7 Social and environmental co-benefits in refrigerator CDM in low-income households

The impact assessment on Coelba's refrigerator replacement (Chapter 1.2.5) is a good basis for describing how households perceived the benefits of the new refrigerator. The following social co-benefits occur

- receiving a status good, from a state related entity, 'citizenship' from utility
- influence Favela organisation through service from local social workers distributing the refrigerators
- nutritional changes
- availability of food (vegetables, diaries)
- cooking meals improved
- food purchasing is more flexible
- electricity grid changes in Favela, less theft, more stable supply

[7] The Southsouthnorth solar water heater methodology is not considered because it was not directly ODA funded although this NGO has also received some ODA funds for other purposes.

These seven different social impacts are significant besides the economic results from the reduction of the monthly electricity bill. Prof. Jannuzzi (2006) calculates that low-income households in Brazil have about 53% subsidy on the full electricity price and the large scale theft of electricity create a context where public services for Favelas are a subject of social policy implemented via the electricity grid. In most Favelas between 10 and 20 different social assistance programmes from the municipal, state and federal governments plus catholic and protestant churches operate. Gas vouchers for the purchase of LPG for cooking is one with similar benefits than refrigerator replacements (described for the Caju case in World Bank, 2006). The energy subsidy levels can be defined with a social cost-benefit analysis whose results change with the refrigerator replacement. Refrigerator replacements reduce electricity subsidies and the cost of the new refrigerators is lower than the subsidy reduction under certain circumstances, according to Jannuzzi. Income from CDM projects would expand these circumstances. No fully calculated case for a given utility and subsidy regulation in Brazil for the societal cost-benefit is available or published.

Coelba is the only Brazilian utility under full operational control from abroad, the Spanish Iberdrola, because the majority owner, the Federal Bank of Brazil (51%) gives up all operational influence. Coelba is the only utility that continuously expands its refrigerator replacements and advocates DSM-type programmes in low-income communities. It is plausible that a pure private business perspective brings the conclusion that subsidies for refrigerator replacements bring a positive result to the profitability. Whereas all other utilities, under various degrees of state interference, do not pursue large low-income community programmes because it does not fit into other social programmes mainly for policy reasons, the state has better instruments than utilities.

CDM projects in low-income communities thus continue to exist independently of the national policy context in Brazil and possibly in many other countries although the social co-benefits are substantial. CDM in low-income communities via appliances offer the highest level of social co-benefits of all CDM types and project contexts. CFL lightbulbs, PV light, solar water, improved cooking stoves, fuel switching of space heating, and refrigerators are a class of CDM, end-use efficiency in low-income households. By their household focus, these are the only CDM projects with gender, health and nutrition co-benefits. At present, there is no comparative analysis of CDM in low-income households available, an important piece of research awaiting to be pursued, possibly when the forty submitted PoAs make their results available. Large social impact assessments for CDM projects have been produced for biofuels, REDD and rural agriculture. Nutritional and health benefits from solar water versus cooking stoves versus refrigerators might be distinct or perhaps reinforce each other.

Environmental co-benefits of replacing old refrigerators are dominated by the destruction of CFCs. Depending on the emissions factor of the electricity grid, the GHG reduction from CFCs is three- to six-fold higher than the GHG reduction from electricity savings. This ratio will decline only in 5-8 years, when less old refrigerators being collected have CFC refrigerants and more used HFC-134a. The following environmental co-benefits are significant:

- Reduction of fossil fuel use in power plants
- Less power transmission losses (in Brazil non-technical losses vary between utilities from1 to 38%, technical losses between 5 and 18 %)
- Energy savings from recycling of metals
- Materials use avoided from metal recycling
- Avoided emissions of CFC and HFC during maintenance of old refrigerators
- Avoided emissions of CFC and HCFC recovered from the PUR insulation foam

Specific environmental co-benefits:

Average material recycling, data per 1,000 old refrigerators (Hornberger 2005):

26 t steel, 2.0 t aluminium, 0.15 t copper, 6.2 t plastics, 4.0 t PUR foam

recycling of steel implies per kg of steel:

0.4 kWh electricity, 225 MJ fuel, 0.06 kg CaO, 0.1 kg iron

recycling of copper (primary minus secondary production) per kg of copper:

Probas/metal/Kupfer-De-primär and Probas/metal/Kupfer-DE-sekundär[8]

0.17 kWh electricity, 6.3 MJ fuel (natural gas)

recycling of aluminium (primary versus secondary production) per kg of aluminium:

Probas/metal/aluminium-DE and Probas/metal/aluminium-DE-sekundär

13.0 kWh electricity, - 3.5 MJ fuel

CFC emissions avoided: 2,454 tCO_2e per 1,000 old refrigerators
plus maintenance 327 tCO_2e per year

Table 14:

All data per 1,000 refrigerators	Direct electricity	Recycling	CFC
	691 MWh	36,4 MWh	
	276 tCO_2e	14.6 tCO_2e	2,454 tCO_2e

Refrigerator recycling under European conditions costs per refrigerator 21.46 Euro, incl. 10.87 Euro income from the sale of recycled metals (UNU 2007: 159). When a recycling plant operates in Brazil and receives emission reduction credits from a voluntary carbon project such as VCS, for the CFC destruction, the income from VER can cover a large part of the recycling cost. The VCS has recently adopted a VCS protocol for the destruction of CFCs. VCS methodologies and VCS projects for household refrigerators are under preparation in a number of countries.

[8] http://www.probas.umweltbundesamt.de/php/themen.php?&PHPSESSID=qigtspxv

2.8 Policy aspects of household refrigerators in low-income population

Low-income communities are a well visible feature of Brazil. Fundacao Joao Pinheiro estimated in 2001 that 6.3 mio households live in inadequate housing. Every year, 1 mio households enter the market for affordable shelter. 20% qualify for subsidized credits for housing materials, and 60% will enter the informal housing sector. *Habitar Brasil, Pró Moradia* and *Carta de Credito* are the federal programmes focusing housing for households below 3SM. Favelas make 30% of Recife, 14% of Rio de Janeiro and 10% of Sao Paulo. *Ministério das Cidades* was created in 2003 also in order to coordinate the many public programmes from states and municipalities.

Since the 1990s public policy toward Favelas had adopted the "enabling" paradigm, helping to organize the supply of services via all types of organisations appearing in Favelas, rather than providing the average infrastructure. Multilateral and bilateral development agencies have often supported participatory planning exercises in many cities. Various phases *Favela-Bairro* programmes have channelled 100s of mio US$ from the World Bank, IBRD and the government into preventing erosion, streets, public lighting, sanitation, and waste disposal schemes. Later *Favela-Bairro* programmes included maintaining schools, kindergartens and employment creation. Enabling the formation of social capital is an explicit goal that requires aligning any project in a Favela with as many local institutions as possible. Local organisations are asked to participate in the information gathering and analysis, in analysis of project alternatives, in decision-making for all components and in decision-making for contracting and budgeting. Without strong local organisations, the sustainability of the results and the impact on social capital are assumed insufficient. The selection of local intermediary organisations is open to all NGOs, associations, public agencies and even universities alike. Each low-income community is approached as an arena of interest group – based and area – based organisations which integrate a Favela project into their agenda. This integration must be tolerated and encouraged in a manner defined for each case.

Brazilian utility companies are often following and copying Favela interventions. Favela customers are seen not as thieves but potential customers (Neuwirth 2006). Some utilities create non-profit spinoffs or foundations, offering service improvements under the condition that households install meters. Electricity is often the first service to be provided due to its comparatively low cost and ease of installation. Universal access to services is imperative in concession agreements, but illegal connections presently undermine private sector service provision. The first step for utilities is to learn more about the needs, preferences, consumption patterns and purchasing power of the Favela population. Utilities such as Coelba, Light and CEMIG have realized that there is a gap that needs to be bridged in establishing new relations with Favela populations and that they are ill-equipped to bridge this gap on their own. This gap consists of (Imparato, 2003: 153):

- Social and cultural differences
- Lack if a culture of consumer rights and responsibilities
- Heritage of paternalistic relations with the state that perpetuates a low-level equilibrium between low-quality services and lack of cost recovery

Coelba, that had two refrigerator replacement CDM projects rejected (see p. 8, Chapter 1.2.2) has attempted to implement refrigerator replacements directly but realised that it could not do so and since only works via an Italian NGO AVSI. AVSI has an agreement with the state of Bahia since 1989 that allowed it to create an alliance between AVSI, the local Roman Catholic archdiocese and local communities. AVSI has been able to provide health and education services in the most difficult Favelas of Salvador, funds came from Bahia, World Bank, EU, Caritas and AVSI itself. Coelba now pays for 115 social workers, employed by AVSI, to implement the refrigerator replacement. An elaborate process is used to select these social workers, leaving them to proceed street by street and call on the technical personal of Coelba when needed. Coelba realises their Favela work within an overall strategy for their low-income clients. In other to be effective, this strategy must comprise: refurbishing wiring, awareness raising on energy efficiency, explain the billing, exchange refrigerators, exchange CFLs, installation of windows, income generation. These components are necessary to pursue together for Coelba to reach these customers. Lightbulbs and refrigerators with 40% of the bill each are the technical part of the package.

Because of the history of public services to Favelas, household refrigerators imply a string of policy issues that need to be addressed:

Price of electricity
Enforcement of bills, re-negotiation of overdue bills
Education on energy efficiency
Access to Favelas
New channels of information
Strong intermediary organisations
Local credibility of intermediaries
Transparent and negotiable conditions for the eligibility of households
Dissemination of information on the impact of refrigerator replacements

These aspects should build on similar preceding activities also because it is too slow and difficult to build them anew. The social and environmental co-benefits allow to link refrigerator replacements to other service providers to low-income communities. These aspects can be aligned in contrasting ways. The utility in Sao Paulo, Eletropaulo, concentrates its efforts in one Favela, Paraisópolis and uses theft proof cables and tele-command meters when refrigerators and lightbulbs are replaced. This comprises a stronger control and punish element compared to Coelba's approach. The cost of these cables and meters are higher but allow the utility to impact the households directly, what Coelba achieves with more on-the-ground presence of the social workers.

While CDM projects can been used to implement energy policy or climate policy, the Brazilian context will always treat refrigerator replacement as an instrument of social policy toward low-income communities. Irrespective of the degree of privatisation, utilities are seen as agents of the state and household refrigerators are instruments to modify the service provided by this state agent. The old inefficient models provide poor service and demand higher power delivered. The new one provides better service and saves the state agent some power generation. Replacing an old refrigerator requires a bargain between the low-income household and the state agent over the benefits. Offering these benefits generously expands the whole benefit while targeting it precisely reflects public interest.

2.9 Estimated potential of AMS III.X in Brazil and worldwide

Brazil - Economic potential:

For 2009, ANEEL estimates 460 mio R$ are being spend in low-income communities from the *wirecharge* by utlities (http://www.aneel.gov.br/area.cfm?idArea=27). At 1,000 R$/refrigerator, this corresponds to 460,000. Using the results from BSH's measurement, 344 CER/1,000 refrigerators are achieved from a CDM project. Assuming a premium CER price because of the low-income community co-benefits of 20 US$/CER gives 6,880 US$ and discounting this at 10% over 10 years is a contribution of 42,270 US$, 77,800 R$/1,000 refrigerators. From 460,000 refrigerators, this correspond to an income of 35.8 mio R$ and if the income would all be used to expand the refrigerator exchange, the total economic potential in 2009 is then 460,000 + 35,800 = 495,800 refrigerators

This calculation should include the benefits from saved electricity generation and saved electricity subsidies, administration and operative cost of CDM and account for the cost of recycling. The information required from the utilities is not available and can not be calculated here.

Brazil – Physical potential:

The physical potential in Brazil is estimated at 30 mio. refrigerators with CFC. In theory this potential must be pursued in the next years because the Montreal Protocol prohibits the import of CFC-12 from 1st January 2010. Remaining stocks of CFC-12 in Brazil will not last long because these old refrigerators have high leakage and are re-filled with refrigerant frequently, estimated average every 2 years. However, refrigerator workshops typically replace compressors (with second hand ones) and re-fill old refrigerators with other refrigerants, HFC-134a or HCFC-22. Good maintenance prolongs the life for 20 and more years. The physical potential will continue beyond the time when CFC-12 stocks are used up.

Total GHG reduction potential from CFC refrigerators in Brazil:

0.09 kg R12 x 10,900 GWP = 981 VER / 1,000 refrigerators

0.31 kg R11 x 4,750 GWP = 1,472 VER / 1,000 refrigerators

electricity savings 334 CER / 1,000 refrigerators

with 30 mio refrigerators the total GHG reduction achievable is 83.6 mio tCO2e

Worldwide, there are 1.2-1.5 bn domestic refrigerators currently in service, representing an estimated bank of 100,000 tons of CFC-12, and approximately 75% of their service refrigerant demand continues to be CFC-12 (UNEP/TEAP, 2006).

From refrigerant in household refrigerators alone that is a physical potential GHG reduction of 1,090 mio tCO2e (CFC-11 in insulation foam 1,600 mio tCO2e). Because it comes from CFC it is not accountable under CDM, it is a co-benefit, that compares to the total GHG reduction from all registered CDM projects of all types worldwide until 2012 of 1,730 mio tCO2e (UNFCCC CDM statistics). The overall environmental co-benefit of replacing all CFC refrigerators is of the same GHG magnitude than all CDM projects together.

AMS III.X is designed for low-income household refrigerators and since CFC refrigerators are predominantly used in such households, the usage of AMS III.X corresponds to the economic potential of replacing CFC refrigerators. This economic potential depends on two factors of similar importance, funds to pay for new refrigerators and funds to pay for the recycling (without which CFC cannot be recovered). The latter is a function of voluntary emission reduction credits because these can, with metal scrap sales added, pay for the cost of the recycling. Recent decisions from the Voluntary Carbon Standard and the Climate Action Reserve correspond to this. If this turns out to be realistic, then the economic potential of AMS III.X application rests with the first factor, the availability of funds to subsidise new refrigerators.

The following table shows estimates of the total number of household refrigerators older than 10 years in the important CDM countries. Brazil is exceptional because the CFC refrigerators are concentrated in low-income communities and the subsidies from public policy for Favelas. More than 90% of Favela households have refrigerators. Whereas in many other developing countries, low-income communities have significantly less (for example New Delhi slums around 50%) and the policy case for such subsidies is lesser. The realistic fraction of these old refrigerator totals depends on utility policy and in some cases on DSM in each country.

Table 15:

Argentina	7,055,000
Bangladesh	1,576,000
Brazil	37,124,000
China	95,962,000
Colombia	6,034,000
Egypt	4,740,000
India	18,258,000
Indonesia	5,018,000
Malaysia	2,641,000
Mexico	14,276,000
Nigeria	5,769,000
Philippines	6,055,000
Russia	33,629,000
South Africa	5,769,000
Thailand	6,624,000
Venezuela	4,203,000

2.10 Climate policy issues of AMS III.X CDM in comparison to the dominant CDM types (AMS I.D, ACM0002, ACM0006, ACM0012 and ACM0001), incl. VER

ACM0002 is used in CDM projects that make half of all CERs from consolidated methodologies, wind and hydro power make the bulk of it.

2.11 Impact assessment for CDM methodologies for social and ecological innovation and poverty impact

The DAC impact evaluation work is a large reform attempt supported by all donors, since a DAC evaluation conference in Tokyo in September 2000. Methodologically all elements had been used before and counterfactuals and causal maps remain useful for the same reasons. What has changed in the last 10 years is the understanding and the systemic use of these evaluation instruments. Hypothesis for impacts are fully articulated and communicated at the beginning of ODA work, variables and tools are communicated to the "target population" and all the way to the policy community in the donor countries. Further the systemic understanding of evaluation requires relating all to similar activities in the local context. Impact evaluation must include an inventory of related organisations, firms and administrations in the local context. Especially donor competition is a new dimension impact evaluation has focused on.

Causal chains in CDM are weaker than elsewhere because carbon markets are in existence for only 5 years. Firms and administrations appear and disappear, carbon trading dynamics change rapidly and the policy intentions pursued by governments evolve just as fast. COP15 in Copenhagen is a good example for a major shift. All carbon market actors are adjusting to the outcome of COP15 and causal chains are modified accordingly. Callon (2009) described carbon markets as *in vivo* experiments, as frequent in financial markets in real scale, mechanisms are set up and effects produced while reactions are taken into account and the architecture altered. As opposed to *in vitro* experiments where test tube laboratory conditions are created in computer models. CDM is *in vivo* and market participants assume it to be a long process with much uncertainty, creating on-going evaluation and learning-by-doing. Callon concludes that this market construction can fail: 'conditions are not cool enough for the spadework for commercial relations'. The political forces drawing the EB into various directions prevent it from creating conditions where commercial ventures are set up to full scale and run long enough for lessons to appear.
Prowse and Snilstveit (2009: 32), found no impact evaluations of CDM:

> We did not succeed in identifying any IEs of CDM projects, indicating that rigorous evaluation of the impact of the CDM has so far been limited and this is likely due to some of the difficulties such an undertaking would involve. This is particularly worrying as the effectiveness of the CDM in achieving its twin objectives of sustainable development and emissions reductions has been questioned in a number of recent publications (Michaelowa and Purohit, 2007; Paulsson, 2009; Schneider, 2007; Wara and Victor, 2008).
> IE of CDM projects must deal with the issue of additionality and while this clearly presents a challenge for evaluators, the current debate on this issue highlights the urgency of developing a rigorous methodology for doing so. Failure to do so runs the risk of scaling up an approach that actually contributes to a net increase in global emissions by enabling Annex I countries to increase their emissions on the back of emissions reductions that would have happened anyway. While establishing a valid counterfactual will clearly be challenging for many CDM projects, a theory based approach to IE could greatly improve the reliability of estimates by alerting evaluators to issues such as the changes in energy policy in China highlighted by Wara and Victor (2008).

Prowse and Snilstveit then propose impact evaluations of CDM could use structural modelling such as computable equilibrium (CGE) models as the most appropriate tool for the task. Here a different route is taken, assuming that innovative work such as this PPP requires more qualitative analysis to capture the impacts.

When Prowse and Snilstveit use additionality as a criterion for impact, they reduce the evaluation to the climate policy debate. This seems not warranted because additionality is a normative variable. Trexler et al. (2006) have shown convincingly that "Using an additionality test to rule out all non-additional projects would lead to many truly additional projects from being excluded from the credit pool". Trexler was a key foresight innovator who steered early investors such as AES into CDM. The additionality question is a kind of thought experiment, holding everything else constant would the project happen without the CDM ? Even if we could read the minds of project developers they themselves may not know what they would have done under different climate concerns. There is no perfect test in statistics. "Any test in almost any field – whether home pregnancy kits or eligibility screening for social welfare programs – will, in addition to correct results, yield false positive and false negative results" (Trexler et al. 2006: 32).

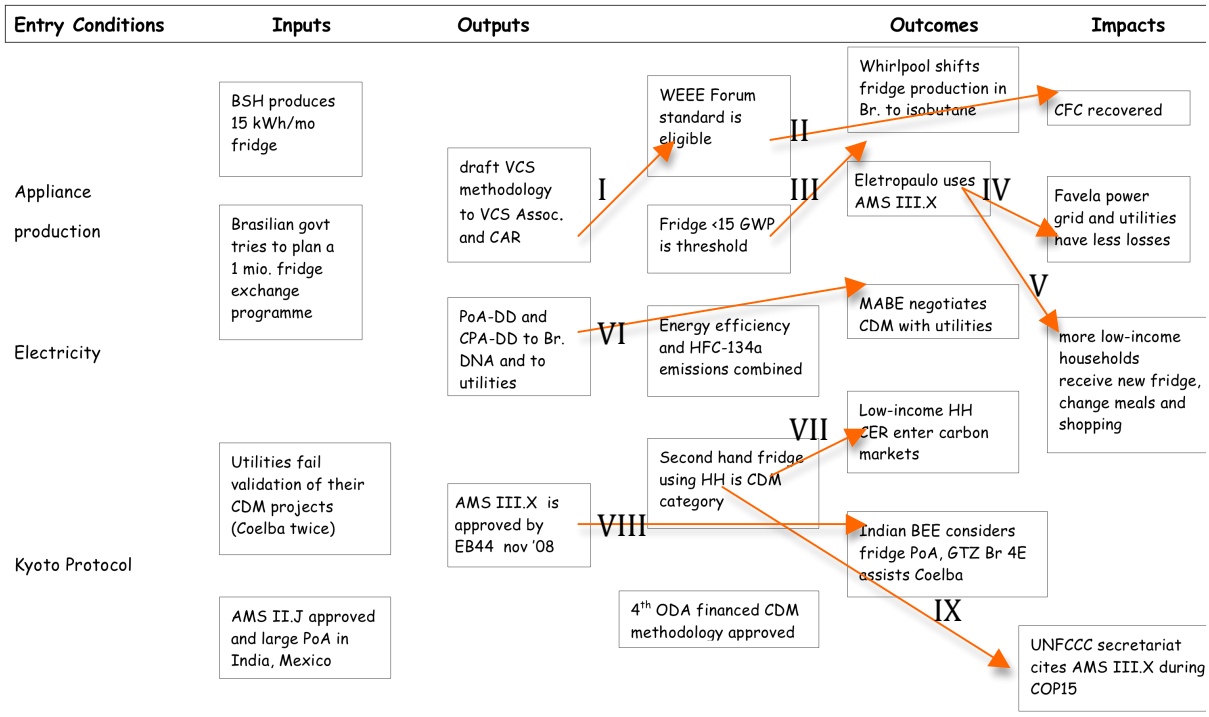
Additionality should not be part of an impact evaluation because it is a playball between those opposing emission caps and those hostile to the extension of market relations, and their arguments have no real difference besides rhetoric. Like a statement that x level of taxation is in principle too high or tool low. The UNFCCC negotiations produce an additionality test and it embodies a normative compromise, what accuracy is imposed to qualify for contributing to a global common. An impact evaluation of a CDM project does not require establishing how much the project adheres to this normative compromise. Instead the evaluation can follow the direct actions in the project and define what goals were pursued and what influence towards them was achieved. All impacts can be captured by relating the PPP to other CDM efforts and establishing qualitatively whether it achieved something others have not.

Assembling the PPP's impacts requires two steps, first, aligning inputs, outputs, outcomes and impacts, typically in DAC fashion fitting the events together so that the

systemic description becomes possible. At this stage the comprehensiveness is of most importance and the measurability is not taken into account. The second step, and this is suggested to make the evaluation adequate to CDM, these causal links should be established at the different levels of events, local, national and international markets for goods and services. CDM involves a large number of levels of events and the interactions among these levels are changing. The multilayered nature CDM regulations often reveals contrasting chains, an EB ruling being used by a DNA to reverse something it could not do before in the national arena (Brazilian emissions factor), and the opposite on another occasion, a DNA ruling forces the EB to do something it avoided before (feed-in tariff for wind power in China). Without wading into cybernetics, CDM can be analysed as an autopoietic organism (Maturana, Varela or Luhmann), it is self-contained and cannot be described outside of it, and is constituted as a network of processes that through their interactions and transformations continuously regenerate and realize the network that produces it.

This graphic is adequate for the period start to end of the PPP GTZ/BSH. It is an inward looking intervention logic aligning events as they were intended to link and the

Figure 24:



outcomes that appeared during the PPP. The first output level are the products, documents that the PPP created and the second output level is the approval of these documents from the UNFCCC entities. Approval of AMS III.X is itself on the first output level because it required direct work, intervention of the GTZ/BSH during the telephone conferences with the SSC WG. The second output level is conceptually attractive because the output intended only comes in existence when another quality is added to the same product, the SSC WG and EB judgements that contain different arguments (causes) than the PPP intentions. This distinction of first and second output levels is adequate for CDM methodology work. The first concerns only the PPP and its participants and with EB approval the same content becomes a global condition. Outcomes are what other actors make of them and impacts are what the

other actors then do related to the intentions of the PPP. The links outcome to impact are clearly measureable and not ambiguous, whereas outputs to outcome remain solely a matter of interpretation. The outcome level is the most selective one because the outputs have created many more than those shown in the intervention logic graphic.

Outcomes and impacts could mostly not be influenced by the PPP but it is possible to predict and also to verify afterwards, what levels of impacts appeared. In other words, these impacts could be pursued in effect but their variables (components) not changed. At each level, one likely impact is described, irrespective of its magnitude.

Theoretically the PPP touched 18 levels of impact:

1	Kyoto, Montreal P.	address HFC-134a for CFC phase-out error and end-use creates ODP reduction conditional on energy saving
2	EU, multilateral bodies	
3	EB, Meth P, SSC-WG	brings EU policy parameter into CDM brings European industry recycling standard into CDM
4	DNA, German govt	1st ODA funded methodology in Germany
5	Recycling technology market	adds new incentive to sell technology
6	National CO_2 markets	increase pro-poor CER supply
7	CDM developer companies	new business
8	CAR, VCS standard	suggest recycling rate eligibility criterion
9	Refrigerator markets	HFC134a - only producers pressured to shift to 600a, Multibras introduced 600a models by Sept'09, recaptured market share it had lost to BSH/Continental, incentive for Cyclopentane in foaming, other example Godrej vs. Videocon
10	Utility companies	provides an accounting frame for their Favela activities provide recycling capacity where there was none
11	Power grids	increased stability
12	Recycling operation	more scrap metal, aluminum, cooper enter the market
13	Bahia, Salvador	Coelba expands its refrigerator replacements
14	BSH	compensate cost disadvantage of quality production
15	Favela, city admin	introduce a new public service
16	Informal sector	job losses for refrigerator workshops
17	Households	food purchases and cooking changes
18	Agente Coelba	employment for social workers

The arrows on the intervention logic are a suggestion of those impact levels that are most significant towards the goal of the PPP.

Table 16:

Intervention logic arrow	I	II	III	IV	V	VI	VII	VIII	IX
Relevance	4	2	4	2	4	4	4	4	4
Effectiveness	4	2	4	1	2	0	1	0	1
Efficiency	1	4	2	3	1	2	4	1	1
Sustainability	4	4	4	0	0	0	4	0	4
Impact	1	4	1	2	4	4	4	4	0
Coherence	2	4	4	1	4	4	4	4	4

The values in the table are the author's view. Collecting this judgement from different stakeholders and from other CDM experts would give a clear result for the veracity of these values. Furthermore this qualification of the intervention logic can be compared directly with Danida's AM0058 and there the causality should be stronger because of the high application of AM0058, whereas the results should be lower for AM0070/71.

The following *Wirkungskette* was produced in the PPP proposal at its beginning (in the *Statusbericht*). The description above can be related to this PPP design assumption and it is the final results of an impact evaluation whether the anticipated causal relations have materialised two years later or not.

Wirkungskette Kühlschrank CDM - Annahme März 2007

Hochaggregierter Nutzen	Stärkung des Kyoto Protokolls und des Montreal Protokolls Zunahme des internationalen Emissionshandels durch CDM Langfristiger Erhalt natürlicher Ressourcen
Indirekter Nutzen	Neue Methodologie für Endgeräteenergieeffizienz entsteht Anpassung von baseline und monitoring methodologien für Slum-upgrading Programme Kombinierte Methodologie für Energieeinsparung und Reduktion Ozon-schädigender Substanzen Stichprobenanalyse für CDM monitoring von variablen Endgeräten demonstriert
Direkter Nutzen	FCKW Emissionen werden vermieden Kühlschrank CDMs werden eingereicht CO_2 Emissionen in brasilianischen Kraftwerken werden vermindert Demand-side management von EVUs wird demonstriert Vertrieb von energiesparenden Kühlschränken wird gefördert Rebound und suppressed demand von Haushaltskälte werden in baselines von CDM methodologien eingebracht
Nutzungen	Brasilianische Kühlschrank CDM Träger beantragen die CDM Registrierung mit den erstellten Dokumenten

	Die Verteilung der Kühlschränke erfolgt nach den Monitoring-regeln der erstellten CDM Dokumente Altgeräte werden gesammelt, das Kältemittel (FCKWs und HFKWs) entnommen und entsorgt Brasilianische CDM Träger erhalten Certified Emissions Reductions (CERs) vom Kyoto Sekretariat Brasilianische CDM Entwickler nutzen die CDM Dokumente zur Steigerung der Qualität ihrer CDM Dokumente
Leistungen	Definition von Pilot Kühlschrank CDM CDM Dokumente PDD, NM werden erstellt Generische PDD und NM Elemente für neue Kühlschrank CDM werden produziert und ein Guide für die Stakeholder Consultation solcher CDM erarbeitet Modellverträge für Kühlschrank CDM Implementierung werden erstellt

Source: PPP Statusbericht GTZ

Two *Leistungen* were not produced, stakeholder consultation and model contracts. All *Nutzungen* occurred but currently only in one case, Eletropaulo's CDM project. One of the *Direkter Nutzen* did not appear, the DSM intention, although physically occurring in Coelba and Eletropaulo, these effects do not come about through the utilities' assessment of the avoided generation cost to define the CDM projects. One of the *Indirekter Nutzen*, integration of refrigerator replacement in slum-upgrading did not appear. All *Hochaggregierter Nutzen* materialized and at the modest level that could be expected.

2.12 Discussion of the interaction between development policy and climate policy regarding CDM methodologies

One observation stands out, the PPP's CDM methodology and projects focus low-income households and this focus is squarely within the group of forty PoAs that appeared. This observation illustrates the interaction between development and climate policy. Demand-side efficiency, low-income households and refrigerators are three CDM issues that combine to create this PPP's pertinence. All three issues are built into CDM projects and methodologies. PoA designs and methodologies are two formats for working on the overlap between development and climate policies. The forty PoAs are a mix of commercial and non-commercial project developers and half of them concern households. Both take risks by submitting them before all PoA regulations are final, the commercial developers anticipating strong demand for carbon from these sources and the non-commercial ones because of the development – climate interaction.

Many carbon finance vehicles are pursuing these issues, especially the MDG Achievement Fund and the CDCF and these funds are slow to develop because there are not as many "high-MDG-effective" CDM projects to invest in. In particular the Kuyasa case, stuck since five years with little expansion or replication and without CER issued, should be used as an indicator for the barriers for supplying these funds.

The COP15 President's Proposal on CDM and the EB's own priorities are oriented in the same direction as the forty PoAs, although to some extent more out of concern for the regional distribution of CDM than out of concern for sustainable development co-benefits.

Three areas for future work on the linkages between development and climate change are evident in this study, the MDG impact of refrigerator replacements compared to the other household PoAs, the suppressed demand typology and thirdly, the DSM and slum-upgrading integration. In these areas the mutual strengthening of development and climate impact can be reinforced.

Better analysis of health and nutrition co-benefits than done by the PPP will allow to design CDM projects for higher MDG impact and increase the value of the certificates in the carbon market. Climate and development impact are almost identical. Similarly for suppressed demand, although not any more for refrigerators, but all the more for CFL, SWH and PV, improving the quantification of suppressed demand will allow to design CDM projects to remove most of it and expand the scale, Climate and development impact are the same. Undoubtedly increasing the integration of DSM and slum-upgrading in CDM projects also strengthens this overlap.

BEE's 400 mio CFL PoA can become a case of DSM integration, while the Senegal CFL PoA can achieve more suppressed demand reduction because of its more accurate monitoring. The PoA format allows to pursue alternative objectives.

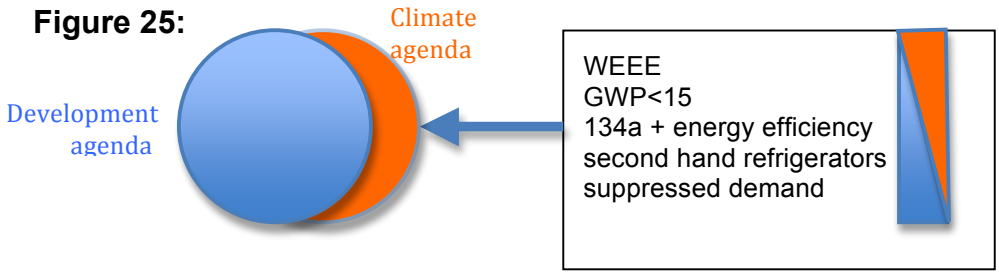
This type of interaction of development and climate policy is specific to appliances in low-income households. All methodology work on these appliances allows to strengthen this interaction (left here as hypothesis), possibly building energy methodologies have these characteristics as well.

The outcome of the PPP on the relation between the Montreal and Kyoto Protocols forcefully adds to the relation between development and climate policy. The Montreal Protocol funded the expansion of HFC-134a as substitute for CFCs but this expansion threatens current mitigation goals. The European F-gas directive contains phase-out goals for F-gases designed to allow achieving the 30% GHG by 2020 reduction in the EU. Gschrey and Schwarz (2009) estimate that HFC emissions share of global CO2 emissions can rise by 2050 to 7.9% (for the IPCC A1 and B1 scenarios) from 1.3% in 2004. So far two HFC emission reduction projects have been approved as CDM, Greenfield manufacturing sites for Polyurethane Foam Panels (ref. 2790 and 2795), using the methodology AMS III.N. AMS III.AB and AM0071 have not been used yet. The PPP contributes to the use of the CDM to accelerate the double phase-out, removing the substitutes of CFC, CDM used to address a failure of Montreal.

A second impact on the relation between Montreal and Kyoto Protocols, is the PPP's impact on CFC destruction. The Montreal Protocol excludes all end-use of CFCs from the mitigation it funds. It is thus evident since a long time that banks of CFCs in appliances and in insulation foam are the only major amount of CFC remaining. The PPP effectively binds the end-use exclusion in the Montreal Protocol to the CDM because AMS III.X credits efficiency and HFC-134a only when a 90% CFC recovery rate is achieved in refrigerator recycling (WEEE-Forum standard).

In sum the interaction between development and mitigation is strengthened in five distinct ways, the first three are unique to refrigerators, in descending importance:

Figure 25:



WEEE is the strongest integrating factor because of the size of the Montreal Protocol gap of end use exclusion. GWP<15 for the new refrigerators forces manufacturers to shift their production from HFC-134a and HCFC-41b if they want to stay competitive. This integrator is only effective as long as AMS III.X remains the only refrigerator methodology available. The combination HFC-134a and energy efficiency in one boundary accelerates the double phase-out and corrects the disregard of the GWP of HFC-134a in the Montreal Protocol. The fourth integrating factor is the second hand refrigerator criterion, it works because the low-cost monitoring in AMS III.X adds to the incentive that the least efficient refrigerators are replaced. And the fifth integrating factor is the automatic crediting of suppressed demand by using the 24h test of the old refrigerators that builds on the fourth factor.

The triangles to the right are an exaggeration. The five reinforce each other and it is reductionist to assume suppressed demand is only relevant to the development objectives because suppressed demand implies low-income households. These households have older refrigerators and thus more refrigerators with CFC, and this increases the importance of the WEEE factor. If one of the five would be missing all four others would be weaker. Development and climate impacts are intertwined in all five.

2.13 Proposals for future support from ODA: which methodologies are developmentally relevant and candidates for ODA work

Donors are challenged to integrate climate change into their operations. Critics are sceptical that the current development architecture can deliver on climate change because its governance does not allow to create instruments that are effective (for example Newell 2008). Looking at portfolios of mitigation and adaptation interventions and affirming that climate change requires some minor adjustments but otherwise means continuing the same policies is not a feasible stance. On the mitigation and on the adaptation side, the challenge is conceptual. Vulnerable groups have economic strategies that protect them against climate change. Supporting these strategies requires a new depth of the capacity development approaches. The most demanding aspect is the communication of risk. Farming systems on marginal land are risk-prone and offering changes to a farming system requires explaining how climate change affects these risks. Likewise on the mitigation side, tools to reduce the energy intensity of growth have been used for 30 years. How can these be adapted to the carbon markets and how can growth interventions enable firms to grow with less inputs while the rules for their competition remain ?

Using ODA for CDM has been popular since its beginning (Michaelowa and Okubo 2009) because in the first phase of market development quality standards and competitive advantages are unstable and innovative interventions might influence them. Measuring ODA funded CDM efforts with the MDG impact is not insightful. Instead, individual CDM projects can be judged on their direct impact and although it is not an easy to sell policy, innovation in CDM types and regulations in itself can be

a contribution to the development of carbon markets per se. Obviously the CDM is an unstable mechanism and the Kyoto Protocol and its successors or its regional equivalents will subsequently render some experimentation useless. However, this instability can be tolerated by accepting that there is no alternative than to kick and push supply and demand for CDM projects wherever possible. Perhaps it is an exaggeration but the efforts of the World Bank could be cited in support of opportunistic ad hoc market influencing. The Bank is certainly overstretching itself by dominating both the supply and the demand side for CERs. But its impact on the market has been effective and although the Bank can not reveal how it chooses countries, CDM methodologies, CDM developers and CER marketing channels, it is evident that it has increased the depth (volume) and the scope of the carbon market by pursuing diversity of its own sake.

ODA for CDM employs a series of approaches: capacity support to DNAs, training for DOEs, support for particular CDM developers, and the most popular, carbon funds for certain CDM types. CDM methodologies are the most direct form of influence on carbon markets and the most unpredictable and difficult one as well. As an instrument of ODA, methodologies allow to experiment with all dimensions of CDM projects together, the target population of CDM (firms or households), the environmental integrity and the profitability (administrative and investment sides). If recently submitted CDM projects submitted by commercial CDM developers show suboptimal features, then new methodologies or changes of existing ones allow to influence the rules of market development.

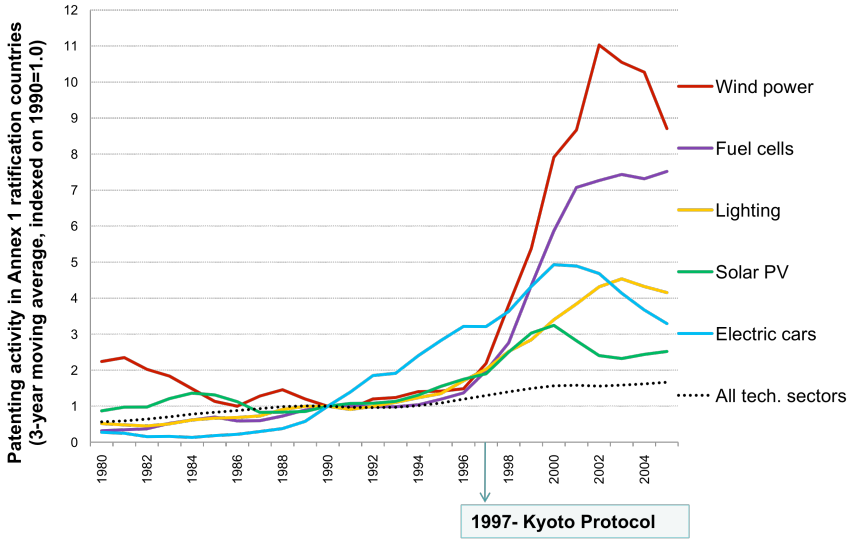
The above is valid for all CDM types and just as difficult for developmentally more relevant types as for the others. Watson and Fankhäuser's conclusion that no sustainable development metric will appear is correct but does not at all exclude to unambiguously define sustainability improvements for a particular CDM methodology. The impact assessment of the PPP demonstrates how ODA interventions on CDM can be compared. Defining in the abstract what methodology is developmentally effective is not helpful. Donors should use impact assessments to distinguish those CDM types they can influence from those that they can not because of their organisational capacity. The instrument of a Public-private Partnership is effective to expand the CDM types in reach of a donor. If Southsouthnorth partners with a solar water heater producer, their changes of success increase. Vice versa, Osram might have sought an ally instead of going alone.

Two suggestions for identifying attractive methodologies for ODA efforts appear straightforward. Among the submitted PoAs (Table 13) only one methodology for a specific appliance is used, II.J for lightbulbs. All others use more generic methodologies and in all of them monitoring costs can be reduced by designing a methodology for particular households. Candidates for ODA efforts can be identified by studying differences in the application of methodologies in CDM projects. To achieve the full developmental potential of solar water heaters or stoves, perhaps five or more different methodologies for each one are required to test CDM project designs and refine and improve the methodology parameters. ODA funded methodologies will influence those from commercial developers even if they do not turn out to be the most popular. AMS III.X is an example of pre-empting a wide open methodology opportunity and a demonstration for assuring that when others try, they have to start with high development impact.

An alternative is to start from an assessment of energy poverty in a country. In many contexts have fuel switching strategies been found to form "energy ladders". The scale of CDM methodology use depends on its impact of the economics of each step. Designing a CDM methodology for a particular step of the energy ladder is dependent on the energy prices in a country and this route to identify methodology changes can be rendered useless when these price change. The advantage is that development impact is the starting point and when methodology changes are approved, the uptake of the revised methodology can be strong.

A final comment ought to concern the relation of methodologies and technology. Some assume these to be synonymous, viewed from outside. Of course CDM has had an impact on technical change in general, and the following graphic shows how the OECD uses this to argue that Kyoto is a success. Nonetheless technical variables are a minor dimension of most CDM methodologies.

Figure 26:



Source: OECD 2010

CDM has played a role in the expansion of wind power and accelerated patenting is an indicator that there is some causality. However in most cases this is a one way street, CDM stimulates technology and not technology stimulating CDM projects or methodologies. The link in between are firms and their business models.

The PPP GTZ/BSH is a good case to illustrate the role of technology. BSH could have expanded its operation in Brazil by integrating recycling in its business model because of the eligibility criteria of AMS III.X. BSH added to this by introducing the 15 kWh/mo refrigerator technology. Bringing CDM benefits to low-income communities is improved by technological efficiency advances but the interest of BSH of adapting its business model is more important.

Translating this to the forty PoAs (Table 13) and their appliances, instead of looking at the specific costs of their CERs and opportunities to lower them via methodology innovations, it is more effective to compare these PoAs and see which business model can be improved via methodologies. Both lead to promising methodology innovations.

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