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REVIEW ARTICLE

Scaling up carbon finance through CDM Programmes of Activities: challenges for low-income household energy projects in South Africa

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The experience with the Kyoto Protocol's Clean Development Mechanism (CDM) so far has shown that there are significant challenges in making the mechanism work for energy projects in households. Programmes of Activities (PoA) have been hailed as a new opportunity to address these challenges by transcending the CDM's single-site approach. Applying insights from research on energy projects in low-income households in South Africa, this article suggests that the successful use of PoA in developing countries is contingent on establishing an appropriate institutional framework, building local capacity, increasing institutional learning around project development, and harmonising evolving carbon finance mechanism. The article demonstrates that the concept of PoA has opened up new opportunities for implementing CDM projects and scaling up mitigation, but that the approach is only effective when situated in a context where diverse stakeholders address the multi-faceted requirements for scaling up carbon mitigation, including among other things, establishing enabling policy frameworks, exploring additional funding options, and developing appropriate methodological approaches.

Keywords: Clean Development Mechanism; energy-upgrade intervention; Programme of Activities; South Africa

1. Introduction

Since the early 2000s, climate change mitigation in developing countries has largely centred on the Kyoto Protocol's Clean Development Mechanism (CDM). The CDM allows for investments from developed countries in projects in developing countries, with the dual objective of reducing greenhouse gas emissions, and contributing to the host countries' sustainable development objectives. Although the CDM may have resulted in emission reductions in developing countries, there is a consensus about the lack of tangible sustainable development benefits in the current project portfolio and regarding the uneven geographic spread of projects (Boyd et al., 2009; Olsen, 2007). These weaknesses, in addition to the urgent need to scale up carbon mitigation actions in developing countries, have led to calls to move away from the CDM's single-site approach (Sterk & Wittneben, 2006).

One of the most promising approaches in this regard is the CDM Programmes of Activities (PoA), a specific CDM activity that was allowed following the meeting of the parties of the Kyoto Protocol (COP/MOP1) in 2005. This decision was triggered by a CDM project proposal relating to energy-efficient air-conditioners in Ghana (Winkler & Van Es, 2007), which highlighted the need for guidance about which project multiple-site project activities would be allowed under the CDM. Under PoA, the normal project-by-project approval is grouped into a broader programme comprising various individual actions of a similar nature (Beaurain & Schmid-Traub, 2010). The aim of this programmatic approach is to widen the CDM portfolio to replicable projects with very low and physically dispersed emissions that would have been tedious and time-consuming to advance on a project-by-project basis (Climate Focus, 2011). Many of these projects can be found in the 'long tail' of mitigation activities (Figueres & Philips, 2007, p. 8; see Figure 1). They include energy-efficiency and demand-side management (EEDSM) projects that involve the deployment of technologies such as solar water heaters, efficient cook-stoves and compact fluorescent lamps. These types of projects have an immense untapped potential to improve the access to modern energy services in the developing world, and the intention of the PoA approach is to support their development.

To lend insights into the design of the PoA approach, and the relative benefits and challenges of this approach, this article examines the deployment of energy-upgrade interventions[1] in low-income households in South Africa through a proposed PoA. The article is organised as follows. Section 2 provides a brief introduction to the rationale behind energy projects in low-income households, and shows why their uptake in the CDM has been slow. Section 3 then discusses proposed mechanisms going beyond the CDM project-based approach, with a focus on PoA. Section 4 zooms in on the implementation

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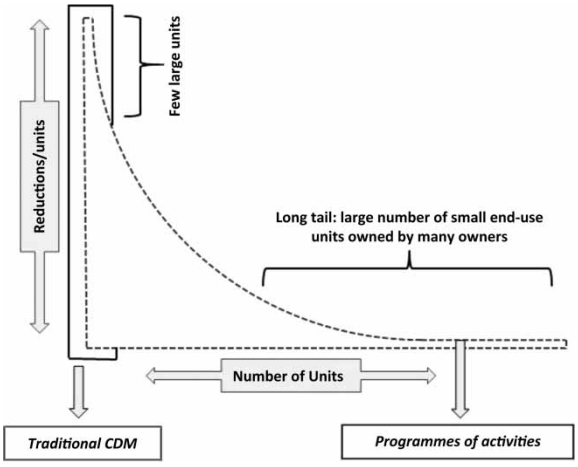

Figure 1. The long tail of greenhouse gas emission reductions (modified from Figueres & Philips, 2007, p. 8).

of PoA in South Africa, discussing the application of the mechanism to low-income households in case sites in Cape Town and Johannesburg. Based on interviews, site visits and document analysis related to the case sites, Section 5 identifies various challenges and opportunities of PoA to stimulate the scaling up of energy-upgrade interventions in low-income households. Section 6 shows how various stakeholders could overcome these challenges, and make use of these opportunities. Finally, Section 7 sums up the key findings and provides recommendations for further research.

2. Energy projects in low-income households and the CDM

The McKinsey global greenhouse gas abatement cost curve shows that energy-efficiency interventions, such as building insulation and improved lighting systems, are some of the most cost-effective options available (McKinsey, 2007). Considering that the world's primary energy needs are expected to grow by about 45% between 2006 and 2030 (with 87% of this growth occurring in non-OECD countries), one would assume that these type of interventions would be viewed as low-hanging fruit (IEA, 2008). In addition, energy-upgrade interventions generally create high sustainable development benefits as they reduce energy poverty.[2] Passive measures of orientation can reduce the need for space heating and solar water heaters offer a further way of reducing dirty fuel use (Irurah, 2000; Sykes, 2009). The combination of some of these interventions in new-build projects could result in estimated fuel cost savings in low-income households of about 70% (Winkler, 2008). A potential rebound effect may reduce energy-efficiency savings, but the exact extent of the rebound effect is not yet clear and depends, among others, on the type of interventions installed in the household and the behavioural responses (Davis, 2011). Figure 2 illustrates how energy-upgrade projects affect wellbeing, through for instance potential cost savings and emission reductions of air pollutants.

Notwithstanding these purported benefits, the implementation of these types of projects through carbon abatement mechanisms, such as the CDM, has been slow (Winkler & Van Es, 2007). Demand-side energy-efficiency interventions represent only 4% of registered projects in the entire CDM portfolio (UNEP Risø, 2012). Moreover, most of the interventions occur in industrial sectors rather than at the household level.

This slow uptake is linked to numerous informational, technical, financial and institutional barriers for energy-upgrade interventions. Without large clusters of viable projects, service providers and financiers are reluctant to support such projects. Viable projects, in turn, are difficult to identify and develop devoid of the supportive market actors to realise a project's execution (Li & Colombier, 2011; Lütken & Michaelowa, 2008). Pursuing CDM credits adds another dimension of complexity to project implementation. What follows is a brief discussion of diverse barriers that affect implementation in developing countries.

Unclear or under-developed institutional frameworks: An operational domestic institutional structure is essential to realise the CDM potential and attract private investors (Lesolle, 2008). Studies indicate that improvements in energy performance of buildings require a comprehensive approach, involving a series of interventions from building design to policy support (Cheng, Pouffary, Svenningsen, & Callaway, 2008; Sovacool, 2009). A project-by-project approach is unlikely to be able to overcome more systemic hurdles, which require the engagement and commitment by various stakeholders in diverse sectors (Sarkar & Singh, 2010). An additional challenge is that the private sector is only likely to commit to project finance and technology innovation if they are confident in the stability of policy processes (Miller, 2008). International financial support can serve to increase confidence in maintaining a domestic policy framework for low-carbon technology and energy-efficiency (Neuhoff, 2009, p. 439).

Dispersed end-users: The most prominent characteristic of household-level projects is their dispersed nature and the numerous, individual small savings opportunities they present. This is also referred to as the collective action barrier, which creates the need for large-scale community involvement and social capital to develop CDM projects (Cheng et al., 2008). For instance, time and money will need to be invested in educating the end-user about the proper maintenance of a newly installed solar water heater.

Principal-agent issue: The principal–agent barrier refers to the fact that the person deciding about energy interventions in households is seldom directly affected by

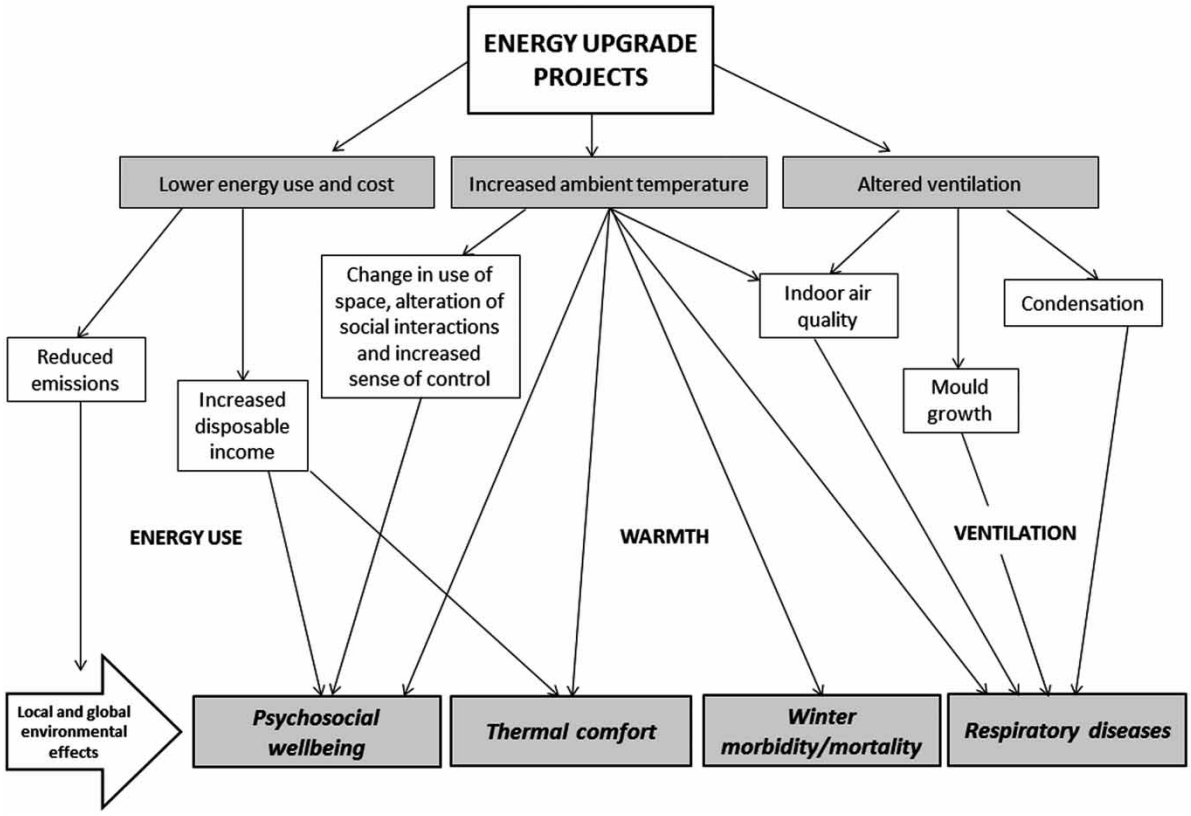

Figure 2. The connections between energy-upgrade projects and wellbeing of the household (modified from Wilkinson, Smith, Beevers, Tonne, & Oreszczyn, 2007, p. 1179).

the outcome of the decision (Jaffe & Stavins, 1994). Most technology enhancements are paid with initial capital investments, whereas energy costs occur during a building's long operational phase. The CDM can create some financial incentive in the form of certified emission reductions (CERs) for these types of projects (Hinostroza, Cheng, Zhu, Fenhann, & Figueres, 2007). However, it is often not feasible for CERs to be the only form of revenue for the projects; therefore, additional financing, such as public resourcing or household buy-in, is necessary.

High transaction and administrative costs: Large amounts of effort and resources are required in order to implement and monitor the small and scattered building projects. Costs and time commitments are driven up because the CDM rules require that each intervention must be monitored separately (Hayashi & Michaelowa, 2007). Thus, interventions such as solar water heaters and space heating must all be calculated separately instead of measuring the downstream output of the home as a whole. Project developers have argued that performance-based methodologies for the project's validation, monitoring, and verification should be allowed, as this would enable the intervention to be monitored as a bundle (Cheng et al., 2008). In cases where there is no approved methodology, project developers often have to submit a methodology proposal to the Methodology Panel of the CDM Executive Board, adding substantial costs and leading to further delays.

Investment costs and life-cycle savings: Energy projects usually require an initial capital out-lay before returns can be guaranteed from fuel cost savings. Many consumers and businesses are not in a position to finance these projects upfront, although such projects would allow substantial savings over the long term. The CDM does not bring carbon finance 'forward' and, therefore, project implementers often struggle to find the upfront capital for such a project (Cheng et al., 2008). In addition, it is not uncommon for low-income households to have illegal electricity connections (USAID, 2004), undermining the financial case for the implementation of CDM projects that would reduce fuel costs.

Fragmentation and complexity: Energy-upgrade projects involve various stakeholders in the construction and operational phases, and their activities are often not well coordinated. This type of fragmentation reduces institutional learning, which could lead to project developers repeating the mistakes of others. This also accounts for why information on energy projects is often unavailable, costly, or difficult to attain (Levine et al., 2007).The complexity of energy-upgrade projects also implies that one

needs educated and skilled project implementers, as they need to be able to use available technologies and adapt them to a country's context.

Suppressed demand: Finally, suppressed demand is a key barrier to household-level energy projects in the CDM. Suppressed demand refers to a situation where levels of access to energy services – before any CDM project – are insufficient. This is mainly due to infrastructure and/or income constraints which do not reflect the real demand for energy services at the household level (Winkler & Thorne, 2002). A key issue is that rule-making has so far focused on historic levels of carbon emissions. The low level of historic emissions in many developing countries leads to such inconsequential creditable emission reductions, reducing carbon revenue opportunities (Thorne, 2011, p. 4).

3. PoA: a possible way forward?

3.1. *Beyond the single-site approach*

Over time, the low uptake of small-scale projects that offer sustainability benefits has led to several efforts to reform the CDM. The CDM Executive Board has allowed the bundling of several small-scale CDM project activities to form a single CDM project activity or portfolio, and has pioneered the PoA model (Beaurain & Schmidt-Traub, 2010). Bundling is suitable in the case of a small number of medium to large units, or a large aggregation of small units that are developed in close proximity to each other and are owned by a limited number of stakeholders. A PoA is appropriate when a large number of small- to medium-sized units are physically spread and appear over a period of time, which is the case with energy-upgrade interventions at the household level (Climate Focus, 2011).

Besides these changes to the CDM, there have been various other developments related to the scaling up of mitigation efforts in developing countries. These notably include nationally appropriate mitigation actions (NAMAs), which originated in the 2007 Bali Action Plan (UNFCCC, 2008). The details of NAMAs are still under negotiation, with an important outstanding issue being the question whether certain NAMAs could be credited. In the development of NAMAs, close attention should be paid to the PoA approach, as it may provide lessons about scaling up mitigation actions in developing countries, the crediting of such mitigation actions, and the options and challenges for monitoring, reporting, and verification of actions. Many experiences could be drawn from including, for instance, learning about effective monitoring and capacity-building on a national level in order to be able to handle carbon finance on a larger scale, or ensuring that mitigation activities are additional (Okubo, Hayashi, & Michaelowa, 2011). Therefore, it is helpful to identify the challenges faced by PoA in order to aid the operationalisation of these future mechanisms.

3.2. *Overview of the PoA approach*

The basic idea behind PoA is to shift the administrative overhead (i.e. transaction costs) away from the single activity towards the programme (Matschoss, 2007). Whereas a stand-alone CDM project must be approved individually by the CDM Executive Board, a PoA needs to be registered only once by the CDM Executive Board. Additional CDM Programme Activities (CPAs), using the same baseline and monitoring methodologies, can then be included at will. This is expected to lower transaction costs, as the registration and verification of CPAs are streamlined. A key party in every PoA is the coordinating/management entity, which is in charge of the management and roll-out of the programme. Prior to registering, the coordinating/management entity must develop the PoA Design Document, which sets out the framework of the PoA (UNFCCC, 2010). In addition, the coordinating/management entity must draft a PoA-specific CDM Programme Activity Design Document, which should include a generic version specifying information relevant to all CPAs that may be included in the PoA, and one version that is based on the application of the PoA to 'one real case' (UNFCCC, 2010, p. 3) . This real case is typically referred to as the pilot CPA.

The coordinating/management entity must submit the CDM Programme Activity Design Document to a Designated Operational Entity for validation. If the Designated Operational Entity considers that the PoA meets the validation requirements it will submit a request for registration of a proposed PoA to the Executive Board (UNFCCC, 2010). In addition, the PoA project developers must submit the project documents to a country's Designated National Authority (DNA), which is in charge of providing host country approval of a project, and which should ensure that the proposed PoA meets the country's sustainable development criteria. The end of the cycle consists of the forwarding of CERs to the account(s) of one or more of the project participants (Climate Focus, 2011).

A look at the PoA pipeline reveals that they include the types of projects that have seen a slow uptake in the CDM due to their low point emissions and dispersed nature, such as energy-efficiency and rural renewable energy projects (UNEP Risø, 2012). Despite the enthusiasm surrounding programmatic CDM, PoA implementation will only be successful 'if continuous funding is provided, the various actors and proponents are brought together in a robust contractual framework, and the operational structure is transparent, functional and sustainable' (Climate Focus, 2011, p. 11).

4. Implementation of CDM PoA in South Africa

This section uses the example of South Africa to examine how the PoA approach functions for energy-upgrade interventions. The section outlines the South African climate policy landscape and the implementation of the CDM

approach, provides an overview of the country's energy and housing policy, and introduces the two case sites.

4.1. *Climate change mitigation policy and the CDM in South Africa*

Climate change mitigation is a key challenge facing South Africa. In addition, the country must still deal with the development issues handed down by the previous apartheid regime (Winkler & Marquand, 2009). Challenges for development include very high levels of unemployment and urbanisation, a lack of access to financial services for poor households scarce public funds, and a severe backlog of government service delivery (Pegels, 2010). This has created tensions between development and mitigation objectives. The CDM is often viewed as an innovative mechanism amalgamating these dual objectives. Additionally, South Africa's high grid-emission factor of 0.99 tCO_2/MWh (due to coal-fired power generation) makes CDM projects more lucrative (Eskom, 2011; Rosenberg, 2007; Spalding-Fecher, 2011). South Africa has established an independent DNA under its Department of Energy and the presence of investment promotion agencies, such as the Development Bank of Southern Africa, has been positive for South Africa's CDM progress.

As of April 2012, the Executive Board has registered 20 CDM projects from South Africa (UNEP-Risø, 2012). This marks progress from the two projects registered in 2006, but in terms of global market share the overall amount of CDM projects in South Africa is still relatively low. The DNA has set priorities for developing the PoA approach and, so far, there are 35 PoAs at validation, two of which has already been registered (UNEP-Risø, 2012). Most of these PoAs are focused on potential solar water heaters and energy-efficient lighting and cooking programmes.

4.2. *South Africa's energy and housing sector: general context*

Developments in the energy sector have a huge influence on South Africa's greenhouse gas emissions. In 2011, it was estimated that 93% of electricity power generation comes from coal-fired power stations, which is mainly supplied by Eskom, the national electricity utility (IEA, 2011, p. 7). As a result, the country urgently needs to transition to sustainable energy if it is to meet the imperative of reducing emissions. Other reasons for doing so include the realisation of the job creation potential of a low carbon future, increased well-being, and improved energy service delivery. Furthermore, the Department of Energy is under severe pressure to meet the development needs of most of the population that were left out of service delivery under the apartheid government.

The development of a 'civil-energy' infrastructure led to a residential electrification rate growth from an estimated 30% in 1990 to 73% in 2006 (DME, 2006). This infrastructure development drive went hand-in-hand with the Department of Human Settlements' mandate to provide low-cost housing in a post-apartheid urban South Africa. The White Paper on Housing of 1994 prioritised the needs of the poor, encouraged community participation, and contained a commitment to deliver one million homes in 5 years (Van Horen & Simmonds, 1998). Additionally, the 1994 Reconstruction and Development Programme emphasised the importance of providing housing for the poor. Although the Department of Human Settlements has a vision of developing sustainable communities, energy-upgrade interventions were not part of the low-cost housing policies until 2003, when subsidies were extended to include ceilings in low-cost housing. However, there has been a lack of uptake of this type of intervention as data shows that the extension of the size of the housing unit is usually the first step taken by households to improve their housing units (Thurman, 1999).

The increasing energy demand in the residential sector, combined with even more significant increases in energy demand by industries have led to power shortages and load shedding as generation capacity has not increased for more than 10 years. To counter this increase in demand, Eskom has tried to develop progressive policy for both sustainable demand and supply-side management in the 2003 White Paper on Energy, and the subsequent 2003 White Paper on Renewable Energy (DME, 2003). In 2005, the Energy-Efficiency Strategy set a target for national improvements in energy efficiency of 12% by 2015 (DME, 2005). Other initiatives include a 30-million units compact fluorescent lamp distribution programme, a one million installed units 'Solar Water Heater Rebate Programme' and deliberations around how to establish a fund for EEDSM which includes a Standard Offer approach (DOE, 2010; van der Merwe, 2011). The solar water heater programme is currently underway and offers installers of solar water heaters rebates depending on the system installed. Recently, the subsidy has been scaled-down due to financial constraints. The Standard Offer approach was developed to support the objectives of the EEDSM programmes under discussion. The basic idea behind the Standard Offer is that organisations that deliver energy-demand savings are entitled to submit projects and would be compensated financially once the project has been implemented and the savings monitored and verified (DOE, 2010). The exact details of this mechanism are still emerging. Despite these reforms, not much restructuring of energy markets has occurred and there has been relatively little policy reform around increasing the sustainability of low-income housing (Goebel, 2007).

4.3. *The case sites: Kuyasa and Cosmo City*

Having sketched the climate change, energy, and housing policy contexts, we examine two case sites where these

three policy areas come together with respect to the CDM. The first case, Kuyasa, is South Africa's first registered CDM project and the first project globally to receive Gold Standard[3] accreditation based on its contributions to sustainable development. The project has generated substantial interest locally and internationally as a best-practice example for energy-upgrade interventions in low-income housing and also serves as the stimulus for a proposed PoA to be discussed further below.

The site for the Kuyasa project is located in the suburb of Khayelitsha, which is a large township on the urban fringe of Cape Town. The vast majority of residents are poor and have moved to this area to live in the houses built here financed through a one-off state housing subsidy (Thorne, 2008). In 2002, the non-governmental organisation SouthSouthNorth Africa (SSNA) approached community leaders in Kuyasa and proposed a CDM project that would include the retrofit installation of solar water heaters, insulated ceilings and energy-efficient lamps in 2309 low-income homes in Kuyasa. Before the interventions, residents used, for instance, paraffin cookers to heat water, which increases the risk of indoor fires and lowers the indoor air quality.

Building on the Kuyasa project, SSNA has developed a PoA incorporating a baseline for all low-income housing in South Africa which would allow for a Kuyasa-type intervention in future developments, as well as previous housing developments, to be credited under the CDM.[4] Two large-scale methodologies have been developed that underpin the PoA. The repeated rejection of these methodologies that included suppressed demand projections in the compliance route, prompted SSNA to present the thermal performance methodology to the Gold Standard for consideration as a voluntary market methodology. The methodology is still pending and SSNA had decided to proceed using existing CDM small-scale solar water heater and thermal performance methodology with suppressed demand elements seeking CDM and Gold Standard certification for the PoA. A generic and a specific CPA are required to accompany the Gold Standard PoA. The specific CPA serves as an example of the type of project which will generate credits under the PoA. The housing development, Cosmo City in Johannesburg, has been chosen as the specific CPA (SSNA, 2010). The Cosmo City energy-upgrade interventions have been funded by the Danish International Development Agency. The proposed interim coordinating/management entity is Carbon Programmes (Pty) Ltd, which is a private company established by members of SSNA with the purpose of managing the PoA.

In addition to pioneering the proposed PoA, SSNA has been engaged in long-term planning for leveraging finance by developing the concept of a Sustainable Settlements Facility. The aim of the Facility is to capture, blend and channel the additional finance needed by developers to enable them to implement additional energy interventions (such as solar water heaters, insulated ceilings, and energy-efficient lamps) in low-income households. The primary finance inputs into the Sustainable Settlements Facility are envisaged to be

- Government subsidies (e.g. EEDSM finance, such as the Standard Offer, etc.)
- Bridging finance (potentially through NAMAs)
- Carbon finance, through the proposed PoA, which is envisaged to be registered with the CDM EB, and certified with the Gold Standard (SSNA, 2010).[5]

Although the PoA is not yet registered with the CDM Executive Board, the development of the Kuyasa and Cosmo City sites provide insights regarding the challenges for implementing energy-upgrade PoA in South Africa, and possibly also for ways of overcoming such challenges. These issues are addressed in the following sections.[6]

5. Challenges for implementing energy-upgrade PoA in South Africa

Drawing on discussions with expert interviewees on the prospects of using PoA for energy-upgrade interventions in low-income households in South Africa as well as site visits to Kuyasa and Cosmo City in July 2011, this section highlights the key financial, institutional, and technical and informational challenges for PoA implementation.[7] The authors acknowledge the non-representativeness of key informant interview techniques (King, Keohane, & Verba, 1994) and the methodological pitfalls of the case study approach (Yin, 1984). To address these pitfalls, we triangulated the results of these methods with document reviews and compared the views of experts from similar organisations.

5.1. *Financial challenges*

Although the PoA approach is an attempt at reducing transaction costs and generating larger revenues by using economies of scale, the specific financial aspects of a programme will ultimately determine the types and terms of financing available for its implementation.

5.1.1. *Financial incentives*

The overarching challenge to make CPAs financially viable requires an assessment of how additional revenue streams could be linked to carbon finance. What is evident from the Kuyasa/Cosmo City case sites is that project developers view the South African government as a key player that might provide additional financial incentives for PoA energy-upgrade interventions.[8] In other words, it is imperative that public money be used to guide project developers and private sector investors towards such projects. For instance, the Standard Offer and the solar water heater

programme can provide a signal to potential CPA developers that there is strong government support for energy-upgrade interventions. Energy project developers questioned whether the government knows how important financial incentives are for not only revolutionising the energy mix, but also for the social benefits that energy-upgrade projects deliver.[9] Financial incentives, such as the Standard Offer, would allow project developers to draw from public funds to make a PoA financially viable.

What is needed is attention for demand-side issues as well as recognition of the importance of financial incentives in stimulating the large-scale uptake of energy-upgrade initiatives (Koeppel & Ürge-Vorsatz, 2007; Sovacool, 2009). This view is supported by a growing consensus that in order for energy-upgrade projects to succeed at the household level, public sector initiatives (e.g. designated government funds) will be needed to build private sector confidence and stimulate investment in the PoA.

5.1.2. *Upfront finance*

The PoA approach provides some hope of bringing carbon finance forward, as CPAs can be included within 2–5 months after a PoA has been registered. Hence, CPA owners could potentially already benefit from carbon credits generated during the first year of operations (Climate Focus, 2011). However, it is unclear how much this will help project developers in practice, as carbon finance will only cover some of the project costs and does not help provide any of the upfront capital costs needed to implement the projects. Indeed, an analysis of the current PoA pipeline indicated that most are still funded through public grants, showing that not much progress has been made in terms of finding new funding sources (UNEP Risø, 2012).

The lack of upfront finance has spurred on the thinking around the Sustainable Settlements Facility concept. The PoA is envisaged to bring in the carbon assets, whereas the Sustainable Settlements Facility is meant to provide the overarching framework that would allow for the upfront finance that project developers could draw from to develop CPAs.[10] Unfortunately, PoA developers do not have many financial and institutional models to draw from to help them structure initiatives such as the Sustainable Settlements Facility. Carbon markets are unlikely to provide the necessary incremental costs for climate change mitigation projects and, therefore, international and domestic communities should explore new financial and institutional models that can provide the necessary upfront finance (Neuhoff et al., 2009).

5.1.3. *Market demand for CERs*

Another challenge for the proposed PoA is that there is still considerable uncertainty surrounding the market demand for CERs, despite the modest progress made at the 17th Conference of the Parties to the UNFCCC in Durban in 2011. Although it was agreed there that the Kyoto Protocol would be extended beyond the first commitment period (2008–2012), it remains unclear which countries other than the European Union will sign up to a second commitment period, and targets – including those for the European Union – are still to be established. In short, the situation in terms of market demand has not changed much (IETA, 2011).

In addition, under the current rules CDM credits from the proposed PoA will only be valid for compliance under the European Union's emissions trading system if it is registered before 31 December 2012,[11] given that South Africa is not classified as a least-developed country. Although negotiators in Durban defined a 'new market mechanism' (UNFCCC, 2012a, para. 83), the details and modalities of this mechanism still need to be agreed upon, making it uncertain whether South African CDM activities would be eligible. Project developers could still sell the credits on the voluntary carbon market if there is no demand for CDM credits post-2012.[12] However, recent decreases in CER prices and the uncertainty about market demand put in question the viability of the PoA approach. Additionally, it is difficult to foresee how long validation of PoAs is likely to take (due to the infancy of the PoA approach), adding another layer of uncertainty to the current situation.

5.1.4. *CER management*

The ownership of CERs is an important issue for investors in the carbon market. It is not determined in the rules and procedures of the Kyoto Protocol and is in principle open to national rules. This might cause problems when CERs are issued for the proposed PoA, as ring-fencing of carbon finance is often not possible in South African municipalities.[13] In addition, direct access to the carbon markets has been inhibited by the legal status of public authorities, their bureaucratic nature, and the uncertainty surrounding the future of carbon markets (Rosenberg, 2007, p. 11). For example, there is a lack of CDM finance and helpdesks in the main cities in South Africa, which means that there is often a shortage of local expertise around carbon project management and the handling of carbon finance. One interviewee from the City of Johannesburg mentioned that there are plans to establish a carbon helpdesk but that thus far these plans have not progressed.[14] This lack of experience in carbon finance poses a risk for the proposed PoA, as the lack of knowledge and appropriate financial entities in the public sector could lead to delays in CPA development.

5.2. *Institutional challenges*

Even if a host country has many attractive PoA project opportunities, it does not necessarily follow that many

projects will be implemented. Various institutional challenges need to be addressed in order to allow for the effective scaling up of energy-upgrade interventions through the PoA approach.

5.2.1. *Government leadership and policy development*

Most interviewees suggested that there is a role for national, provincial, and local governments in aiding the progress of project roll-outs. The interviewees from South African government departments echoed these sentiments and agreed that the definitive role for government is the development and implementation of clear and coherent policies across the country.[15] Although there is awareness among government officials of the importance of energy-upgrade interventions for low-income households, and various departments are currently working on energy-efficiency legislation,[16] it is often hard to gain support for energy-upgrade projects as municipalities depend on selling energy to subsidise their budgets and, therefore, stand to lose income if energy-upgrade interventions are mandated.

The government could act, among others, as an independent information broker; as the body responsible for the development of energy-efficiency standards and guidelines; or as a coordinator of the various public and private entities. The interviews pointed to a low awareness on case studies that have piloted the types of interventions discussed in this article.[17] This is unfortunate, as previous CDM or PoA projects are a good way to learn how viable new project ideas are, gain practical experience from past experience, and establish and promote good practices. In addition, the establishment of clear national standards and regulations could create the enabling domestic environment for international support that could enhance the uptake of these projects. Lastly, increased coordination and management between different governmental departments could deal with the complex interface of mitigation, development, sustainability, energy, and housing issues. When governments overcome a silo approach, energy-upgrade interventions could be viewed as providing numerous benefits such as lowering health care costs, fostering low-carbon development, and reducing greenhouse gas emissions at the household level.[18]

5.2.2. *Institutional capacity*

Another challenge relates to the institutional capacity of DNAs to deal with the PoA. DNAs seem reluctant to issue a letter of approval for a PoA because, after issuance, they will no longer have the authority to state anything about subsequent CPAs. The Executive Board has been requested to provide more guidance, including a sampling approach to sustainable development evaluations in order to help host countries speed up the process and reduce regulatory delays (UNFCCC, 2011). This will be necessary for DNAs to effectively communicate and guide the PoA development in countries. With respect to the South African DNA, capacity-building and further training might be necessary to enable the DNA to set country-wide PoA objectives and allow for consistent and effective communications with PoA project developers. If a PoA begins to support certain policy objectives or even policy roll-out, the DNA's mandate will become more important and its functioning needs to be supported (Cheng et al., 2008, p. 54). In addition, Designated Operational Entities play an integral part of PoAs, as they must verify that the project meets the basic eligibility criteria, ensure that stakeholders are consulted, and finally provide a request for registration to the Executive Board. Currently, South Africa is lacking local Designated Operational Entities, adding to the costs and time it takes to validate projects.[19] Considering that the PoA approach will require substantial, continuous monitoring and verification of CPAs, the issue of local skills and capacity building will therefore need to be addressed. The proposed PoA is being validated by a foreign Designated Operational Entity, which is charging sizeable amounts to assess the Cosmo City as the proposed specific CPA.[20] It will be important to build the skills for such procedures, as the scaling up of mitigation actions in the form of NAMAs is likely to include monitoring, reporting, and verification requirements (Cheng, 2010; Wang-Helmreich, Sterk, Wehnert, & Arens, 2011).

5.3. *Technical and informational challenges*

While some progress has been made to accommodate energy projects in low-income households under the CDM, PoA may still face several methodological and technical challenges. In addition, education and informational issues will need to be given due attention.

5.3.1. *Methodologies and baselines*

Project methodologies for project types with numerous locations, several emission points, and indirect effects have often been rejected by the Executive Board because of the difficulty to establish a clear connection between the measure and the emission reductions (Hayashi & Michaelowa, 2007). SSNA has vast experience with the difficulty in getting methodologies approved and has attempted to submit a large-scale solar water heater methodology roughly eight times and a large-scale thermal performance methodology three times thus far for use in the proposed PoA.[21] Both methodologies feature the idea of a suppressed demand approach, which was pioneered in Kuyasa, and both establish low-income household project baselines.

Recent developments, such as the approval of guidelines and methodologies on suppressed demand by the Executive Board (e.g. the Executive Board recently approved a

methodology for rural electrification) (UNFCCC, 2012b), are a step forward in moving towards standardised baselines that reflect the realities faced by low-income household projects. Despite this apparent progress, the Executive Board will need to take the idea of suppressed demand further by standardising baselines, which would save project developers' time and money, harmonise approaches, and ensure the consistent treatment of suppressed demand (GERES, 2011). Additionally, it is advisable that countries begin collecting information on the emission baselines of different sectors (Aasrud, Baron, & Karousakis, 2010). This would support the PoA by increasing access to relevant information for the CPAs, and reduce the PoA administrative burden of generating baseline information.

Further, the monitoring requirements that are outlined in most methodologies remain complicated and costly under the PoA. The proposed PoA in South Africa intends to implement numerous interventions, and to monitor multiple technologies that have agreed suppressed demand default emission reductions. This limits monitoring to whether or not a technology is used and thus reduces cost for project developers and Designated Operational Entities. Therefore, interviewees highlighted that the Executive Board should make progress on performance-based methodologies that include suppressed demand where appropriate, allowing project developers to move away from measuring energy consumption or performance on technology-by-technology and measure-by-measure approaches.[22]

5.3.2. *Implementation and maintenance*

Many mitigation projects in developing countries have become unsustainable due to inadequate attention to the availability of local skills for installation, operation, and maintenance. What became clear from the site visits in Kuyasa and Cosmo City is how implementation and maintenance will determine the viability of the PoA. Beyond the provision of financial support and physical supply of technological equipment, the viability of low-carbon technology under the PoA will be dependent on sound implementation measures and the provision of thorough maintenance in order to harness the full sustainable development benefits of each CPA in the future. For instance, the site visit at Cosmo City revealed that often the original house structure is of low quality, which means that installation of interventions might undermine the original structure of the home. This ends up causing leakage through the roofs in the post-intervention stage. If project developers would share information with each other on best practices for installations, such situations could be avoided. In addition, these issues need to be communicated to provincial housing departments, which control standard-setting in low-income households, in order to create awareness about the difficulties of installing interventions in homes made of such least-cost materials. One of the benefits of the PoA approach is that the coordination/management entity has the opportunity to set standards for implementation of the future CPAs, and that it can create awareness around these types of issues with contractors, communities and government. The coordination/management entity for the Cosmo City PoA has not been registered yet; it is however envisaged to play a vital role in enabling knowledge transfer and overseeing effective operations.[23]

5.3.3. *Education*

A more fundamental problem with the CDM is that the approach has been carbon-centric, with an emphasis on mitigation and technology compared to other issues such as behavioural change and human capacity. The Kuyasa/Cosmo City cases show that the successful uptake of low-carbon interventions requires extensive education and engagement with local communities. For instance, in Kuyasa some families at first thought that the solar water heaters gave them access to free water. Such misunderstandings can be common when the interventions are new to a community and, in the case of Cosmo City, a team of 60 local educators were hired to try to avoid such misunderstandings.[24] It is ultimately at the end-user level that the emission reductions will occur and, therefore, close integration of the end-user into the PoA is advised (Climate Focus, 2011). CPA managers will have to take cognisance of such issues and factor it into their management plans and budgets.

6. Addressing the challenges: who can do what?

The previous section has revealed various challenges for the use of the PoA in energy projects in low-income households, using the case sites of Kuyasa and Cosmo City as an example. This section explores how key actors, including the South African government, PoA project developers and members of the CDM Executive Board and Parties to the Kyoto Protocol, could help address these challenges.

6.1. *The South African government*

The government has a distinct role to play in the success of PoA in terms of providing leadership, creating an enabling policy framework, building capacity, and preparing for mitigation actions in low-income households in the long term. Given the local sustainable development benefits of the interventions for low-income households of South Africa, political buy-in seems logical. Individual projects implemented under the CDM might be able to exist in a policy vacuum but this is increasingly difficult with a PoA as countrywide implementation will increase the frequency of interactions between the project and the government.

The inconducive policy environment makes it hard to implement additional case sites such as Kuyasa and Cosmo City. It is therefore suggested that governments should place less emphasis on supply-side infrastructure development and explore some of the available policy mechanisms available to promote energy efficiency and the deployment of solar water heaters at the household level. Institutions such as the National Energy Regulator – established to implement energy regulations – could explore wealth redistribution schemes to fund education programmes, protect the poor from price hikes, and provide money for project developers initiating energy-efficient projects in households. In this regard, Painuly, Park, Lee, and Noh (2003) suggest that governments (or institutions such as the National Energy Regulator in the case of South Africa) should explore public finance and technical assistance possibilities with financial institutions such as the World Bank and regional development banks. However, given that Eskom has an energy supply and management monopoly, deeper institutional issues will have to be addressed before a conducive policy environment can be created for the proposed PoA in South Africa.

In addition to addressing issues around policy reform and political will, it is also important for the South African government to think about the medium to long-term implications of a post-2012 climate policy landscape where PoAs might be part of a NAMA. The PoA experience is extremely valuable for designing appropriate large-scale mitigation actions in South Africa. If a future NAMA were to generate carbon credits – a matter still to be resolved in the negotiations – this would require many more auditors with host country experience for verification. Therefore, addressing the challenges that the current proposed PoA faces will allow South Africa to be well-prepared for an international carbon crediting mechanism.

6.2. *PoA project developers*

One hurdle that PoA project developers will need to overcome is working out how to address the financial challenges faced by the PoA. There are unfortunately not many functional business and institutional models that PoA project developers can draw from. One model that could be proposed to local banks is the 'clean energy lending programme' by the International Finance Corporation, which provides technical support and partial risk guarantees to households and project developers through local banks (Miller, 2006). Other options that could be explored is to market the PoA in a way that encourages the financial sector to view carbon finance as another avenue for increasing the bankability of projects through its contribution to capital costs, thus reducing risks and improving security (Lesolle, 2008, p. 42). Additionally, the blending of different finance streams such as EEDSM and carbon finance will need to be piloted in order to ensure the long term viability of the PoA. The viability of a financial model such as the Sustainable Settlements Facility depends on such piloting, and experiences will need to demonstrate the viability of combining finance streams with a view to scaling-up projects.

In addition to the financial issues, the proliferation of stakeholders involved in the PoA will require the coordination/monitoring entity to screen the involvement of, for example, CPA developers. This is emphasised by Haya (2009), who points to the fact that USAID projects on renewable energy and bagasse cogeneration in India were successful because they had been developed by individuals who had worked on similar projects for years, were familiar with the barriers to the technology and the local conditions under which the programmes had to be implemented. These types of project management requirements could be included in, for instance, a robust project management system which could comprise of a web-platform, stakeholder meetings reports, and policy briefs (Beaurain & Schmidt-Traub, 2010; Climate Focus, 2011). Such a project management system should ideally also include CER management agreements so that uncertainty regarding CER ownership is avoided. Additionally, clear agreements with Designated Operational Entities on response times and defining internal responsibilities between the diverse stakeholders will be vital to avoid delays in project development.

6.3. *The CDM Executive Board and parties to UNFCCC/Kyoto Protocol*

The case studies indicate that overall rules and procedures for PoA will still need to be refined. In particular, the Executive Board could accelerate progress by elaborating on concepts such as suppressed demand, and tailoring these approaches for PoA use. This could make low-income household projects more financially attractive, and reduce costs of monitoring, reporting, and verification processes (Cheng et al., 2008). An additional barrier that will need to be addressed is the Designated Operational Entities' capacity to deal with the monitoring, reporting and verification requirements of a PoA. As the extended arm of the Executive Board, Designated Operational Entities need to be incorporated and considered in the Executive Board decision-making process (Figueres & Streck, 2009, p. 235). Therefore, the success of the PoA approach will depend on how this relationship is negotiated under existing PoA rules and how issues such as capacity-building and skills development are handled. Additionally, the Executive Board could further provide guidance to DNAs on sampling and sustainable development evaluations. What might also be useful is fostering South–South transfer of knowledge on the challenges and opportunities around utilising the PoA approach for energy-upgrade projects in low-income households. Overall, there seems to be

Table 1. Roles and responsibilities of the various stakeholders in facilitating PoA development.

	Financial challenges	Institutional and policy challenges	Technical and informational challenges
Government	• Guarantee financial incentives for stakeholders in the PoA • Increase governmental capacity to handle carbon finance flows	• Align policies with mitigation and sustainable development objectives • Coordinate across relevant departments and design a conducive policy framework • Increase the capacity of the DNA • Utilise PoA experiences to inform future NAMAs	• Support local monitoring and verification capacity building procedures • Invest in establishing emission baselines
PoA project developers	• Outline CER ownership • Explore alternative revenue sources and financial models with other stakeholders	• Involve stakeholders from business, NGOs and local/regional governments • Foster institutional learning and best-practice methods	• Set clear management rules for maintenance and educational procedures • Draft agreements with Designated Operational Entities on response times and define responsibilities with stakeholders
CDM Executive Board and Parties to the Kyoto Protocol	• Ensure the future viability of CERs from PoAs by fostering the development of appropriate market mechanisms • Develop models that investigate how carbon finance and public funding can scale-up low-carbon development	• Provide DNAs with further guidance on sampling and sustainable development criterions • Provide opportunities for South-South transfer of PoA experience • Foster compatibility between PoAs and NAMAs	• Increase utilisation of standardised baselines and suppressed demand in CDM methodologies • Streamline the use of performance-based methodologies • Explore developing other indicators of success beyond carbon mitigation

a need for enhanced sharing of experiences in PoA project implementation as the current modalities and procedures did not build up enough concrete and real experiences in energy-upgrade projects.

Another issue that could be addressed in the international climate negotiations is the long-term vision for mitigation actions. Currently, PoA is one of the most feasible options for scaling up carbon mitigation under a market mechanism, although NAMAs (to the extent they are credited) or the new market mechanism defined in Durban in 2011 may fulfil this role in the future. It also promises to play a vital role in strengthening CER supply and carbon markets' maturity in general (Avendaño, 2008). However, in the medium term, the PoA reform agenda ideally needs to be connected to the ongoing discussions on NAMAs to address concerns about how such approaches will co-exist and interact. In addition, parties to the UNFCCC and the Kyoto Protocol might want to explore other options beyond just carbon mitigation as a measure of success for an intervention by, for example, differentiating carbon credits based on other indicators such as their sustainable development contribution (Bakker, Haug, van Asselt, Gupta, & Saïdi, 2011). Such developments could increase the attractiveness of implementing projects in energy-upgrade interventions in low-income households.

7. Conclusions

CDM PoAs have received increased levels of attention in the international climate negotiations and are likely to continue to attract support, even as the Kyoto Protocol's first commitment period draws to a close. This article has explored some of the challenges faced by PoA, and has indicated what roles and responsibilities diverse stakeholders could take on to enable the effective utilisation of the PoA approach. More generally, the case studies reveal some of the broader challenges surrounding the scaling up of climate change mitigation in developing countries, and illustrate how PoAs could be utilised to prepare for sector- or countrywide mechanisms such as NAMAs.

The case sites of Kuyasa and Cosmo City illustrate that the PoA approach is poised to enable the scaling up of energy-upgrade interventions, drawing on the experiences gained from the Kuyasa CDM project. However, despite the apparent benefits that the PoA approach offers, in terms of reducing transaction costs and centralising organisation, it still requires that numerous financial, institutional, and technical and informational challenges are addressed within one implementation framework.

Different roles and responsibilities can be identified for various stakeholders such as the government, the PoA project developers, and the CDM Executive Board and the parties to the Kyoto Protocol. It will be up to these stakeholders to create an enabling environment by, among other things, establishing an enabling policy framework,

exploring additional funding options and developing appropriate methodological approaches. Only through creating such an enabling environment will the effective utilisation of the PoA approach be possible. These efforts will also offer significant opportunities to learn-by-doing for more long-term mitigation approaches such as NAMAs. Table 1 recapitulates the roles and responsibilities of the various stakeholders in facilitating PoA development suggested in this article.

Finally, this article shows that there are still some evident research gaps. Further research could provide insights into effective PoA implementation and allow PoA project developers and governments to learn from the experiences of others. It is impossible to anticipate all the challenges that a PoA may face but important lessons can be drawn from case studies such as the proposed energy-upgrade PoA examined here. Lessons learnt will be able to strengthen the still sparse body of research addressing the enhancement of mitigation approaches in developing countries.

List of interviews conducted (July–August 2011)

- Steve Thorne, Director, SouthSouthNorth Africa
- Shehnaaz Moosa, Carbon Technical Manager, SouthSouthNorth Africa
- Carl Wesselink, Director, Carbon Programmes
- Robin Siebert, Project Manager, Basil Read Construction
- Emily Tyler, Independent Climate Economist (formerly SSNA)
- Rohitesh Dhawan, Resource Economist, KPMG South Africa
- Holle Wlokas, Researcher, Energy Research Centre, University of Cape Town
- Anonymous, City of Johannesburg
- Dipuo Peters, Minister of Energy, South Africa
- Adam Simcock, CEO, CarbonCheck

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Notes

1. Energy-upgrade interventions refer predominantly to the installation of energy-efficiency ceilings and low-pressure solar water heaters. The term is not commonly found in the literature as most studies usually focus on only one intervention at the household level.
2. Energy poverty is a term for the lack of access to energy services (Barnett, 2000).
3. The Gold Standard is a non-profit organisation that offers a certification scheme for premium quality carbon credits with sustainable development benefits for both the CDM and voluntary markets (Gold Standard, 2011).
4. Interview with Steve Thorne, SouthSouthNorth Africa, July 2011.
5. Interview with Shehnaaz Moosa, SouthSouthNorth Africa, July 2011.
6. Recently, the Sustainable Settlements Facility has been reconsidered as a NAMA under the UNFCCC. The NAMA is envisaged to be Gold Standard compliant, making use of PoA elements, particularly in its monitoring, reporting and verification processes.
7. Details of the interviewees are included at the end of the article.
8. Authors interviews' July–August 2011.
9. Interview with Carl Wesselink, Carbon Programmes, July 2011; and Robin Siebert, Basil Read Construction, July 2011.
10. Interview with Emily Tyler, August 2011.
11. This marks the cut-off date to have credits accepted from non-LDCs for the third trading period of the EU emissions trading system, which starts in early in 2013 (European Union, 2009).
12. Interview with Rohitesh Dhawan, KPMG South Africa, August 2011.
13. Interview with Holle Wlokas, Energy Research Centre UCT, August 2011; and Shehnaaz Moosa, SouthSouthNorth Africa, July 2011.
14. Interview with anonymous official, City of Johannesburg, July 2011.
15. Authors' interviews July-August 2011.
16. Interview with Dipuo Peters, Minister of Energy, July 2011.
17. Authors' interviews July–August 2011.
18. Interview with Emily Tyler, August 2011.
19. Adam Simcock, Carbon Check, August 2011.
20. Interview with Carl Wesselink, Carbon Programmes, July 2011.
21. Large-scale project methodologies can be utilised by projects of any size, whereas simplified small-scale project methodologies can only be applied if the activity is within a certain limit (UNFCCC, 2012c: 32). SSNA is trying to develop large-scale methodologies so that the activity size is not as limited as under the small-scale methods.
22. Authors' interviews July–August 2011.
23. Authors' interviews July–August 2011.
24. Interview with anonymous official, City of Johannesburg, July 2011.

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