Sustainable Cities and Society 34 (2017) 69–78

Contents lists available at ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Valuing co-benefits to make low-carbon investments in cities bankable: the case of waste and transportation projects

Kaveh Rashidi[a,b,*], Martin Stadelmann[b], Anthony Patt[a]

[a] Department of Environmental Systems Science, ETH Zurich (Swiss Federal Institute of Technology), Universitätstrasse 16, 8092 Zurich, Switzerland
[b] South Pole Group, Technoparkstrasse 1, 8005 Zurich, Switzerland

ARTICLE INFO

Keywords:
Co-benefits
Climate mitigation policies
Low carbon investment
Financial modelling
Cities

ABSTRACT

Urban areas account for 70% of carbon emissions, and are likely to be the locus of attention to reduce future emissions in developing countries. However, only a small share of Clean Development Mechanism (CDM) projects under the Kyoto Protocol and only 30% of public climate finance is invested in urban areas. One of the main reasons is that most urban climate change mitigation projects rather provide development than climate benefits, so the question is whether alternative mechanisms can mobilize urban mitigation projects. In this paper, we analyze a set of three case studies — representative urban waste and transportation projects in Indonesia, Kenya, Sri Lanka — to compare the market and economic value of climate and development co-benefits. For the projects, we monetize the co-benefits accruing to the local community. We find that under current market conditions, climate benefits have little effect on projects' financial viability, and can be effectively ignored. By contrast, we find, the monetization of development co-benefits significantly improves financial viability, based on calculated net present values and internal rates of return. Our results highlight the importance of local, national and international financing and policies that monetize such development co-benefits.

1. Introduction

Since cities are responsible for more than 70% of global greenhouse gas (GHG) emissions and generate over 80% of global income, they are in a prime position to tackle increases in GHG emissions (World Bank, 2010). It is expected that, by 2030, about 2 gigatons CO_2eq of GHG emissions should be cut per annum in order to reach the 1.5 ° level by 2050 (CAT, 2015). To make that happen, cities must take concrete steps towards defining and implementing various low-carbon projects and mitigation policies. Moving from business as usual (BAU) to a low carbon future requires an annual investment of between US$4.5 and 5.4 trillion globally (CCFLA, 2015). Transportation and waste projects require the majority of the infrastructure investments, and it is estimated that these sectors require $2 and 0.83 trillion, respectively, of low-carbon investments per annum until 2030 (CCFLA, 2015).

There have been various strategies, in the form of regulatory or market approaches, to boost low-carbon investments in cities. Regulatory mechanisms, such as policies that target a reduction of air pollution or ask to observe certain environmental concerns while implementing a project, are present in developed economies. Advanced market mechanisms, such as cap-and-trade systems in Tokyo and California where they motivate carbon offsetting with relatively acceptable prices also exist (Nishida & Hua, 2011; Reyna, 2014). However, the situation is somewhat different in developing countries; often, they lack both regulatory and market approaches. To address the latter, the Clean Development Mechanism (CDM) was introduced under the Kyoto Protocol in order to create a market approach in those countries. While it was initially successful in channeling billions of U.S. dollars per annum to project developers worldwide, today its effectiveness is seriously criticized. The low or almost zero price of certified emission reductions (CERs) is no longer an impetus for project developers to invest in low-carbon infrastructure. This stems from the fact that the benefits compared to the transaction costs are limited (Trotter, da Cunha, & Féres, 2015). There have been a number of examples in which the crash of the carbon price made it financially difficult for project owners to sustain the project (Wang et al., 2016). It is noteworthy to mention that, even during the shiny years of the CDM market, the total amount of financial transactions (with around $6 billion at the highest point in 2012) was relatively small to fill the required investment gap for low-carbon projects in developing countries.

Apart from the very low carbon price and limited international public finance support, low-carbon investments in cities are facing

* Corresponding author.
E-mail addresses: kaveh.rashidi@usys.ethz.ch (K. Rashidi), m.stadelmann@thesouthpolegroup.com (M. Stadelmann), anthony.patt@usys.ethz.ch (A. Patt).

http://dx.doi.org/10.1016/j.scs.2017.06.003
Received 12 July 2016; Received in revised form 24 May 2017; Accepted 9 June 2017
Available online 15 June 2017
2210-6707/

other barriers. Difficulties in the inclusion of climate mitigation goals in urban planning, as well as a lack of cities' capacity and knowledge to develop low-carbon projects, are the major impediments to climate financing in cities (CCFLA, 2015; Homsy & Warner, 2014; Ryan, 2015). Urban policy makers are also reluctant to invest in a local project that has a global benefit somewhere else (CCFLA, 2015 Homsy & Warner, 2014). This lack of enthusiasm stems from the existing unclear, or sometimes ambiguous, perceptions about climate change by the urban policy makers. On the other hand, climate change scientists mainly define climate policies and their respective impacts in sophisticated terms that are often misinterpreted by both public and private investors. In most cases, this misapprehension has yielded to ignorance in city-level environmental planning in consideration of the mutual impact of other policies from other sectors (Puppim de Oliveira et al., 2013).

One way to raise awareness among decision-makers and investors is to redefine the concepts of climate-change-mitigation benefits and possible effective solutions. Climate policies and their non-carbon benefits, if translated into economic terms, can attract attention from both public and private entities (Bain et al., 2015). Classic definitions of climate policies rest on the delineation of GHG reduction targets, disregarding other positive impacts that the policies might yield. A report by the Intergovernmental Panel on Climate Change (IPCC) reiterated the importance of considering another class of external benefits of climate policies that are local in character (IPCC, 2014a). Calling them co-benefits, the IPCC defines them as "…benefits from policy options implemented for various reasons" while "acknowledging that most policies resulting in GHG mitigation also have other, often equally important rationales." For instance, an air pollution reduction policy with the primary goal of reducing GHG emissions results in secondary benefits, such as job creation, health benefits, or appropriate land use. Identification of co-benefits when addressing climate change also shapes and motivates the citizens' mentality. Bain et al. (2015) mentioned that communication of the co-benefits associated with climate policies would create active engagements and motivations by both governments and individuals.

By recognizing the co-benefits of low carbon investments, investors, donors and city officials can go beyond valuing GHG reductions through carbon credits. This means that the voluntary actions can be paid not only on the amount of emissions they reduce, but based on the co-benefits they generate. The consideration of co-benefits in city projects is advantageous for two groups: First, city officials and city inhabitants themselves can prioritize investments in GHG mitigation projects with high local benefits, when they value local or their own benefits. Moreover, they can receive additional external support from donors for low-carbon investments that do not pay off because of local benefits alone. Second, donors and climate finance providers can value the double development and climate goals they often have, and assure a clear impact of their investments, when using a mechanism where payments are only released once climate and co-benefit results have been monitored, reported and verified. It is important to mention that cities, in comparison to national governments which are committed to observe certain GHG emission targets (United Nations, 1998), do not see the necessity to invest in the projects that have unclear and indirect local benefits (Puppim de Oliveira, 2013; Ryan, 2015). In other words, they would invest in the projects that can financially and locally (economically) make sense. Therefore, it would be of interest to incorporate the co-benefits of climate policies into financial analysis where policy makers can see the effectiveness of their policy decisions.

In light of the above, through the valuation of co-benefits of climate policies, this study intends to find out the overall impacts they will have on the project's financial and economic returns. We examine this using three cases from low carbon investment projects in the cities of Balikpapan, Nairobi and Colombo.

2. Background

City governments and municipalities are in the leading positions to address the challenges as well as responding to the welfare needs of their citizens (McGinnis, 1999). Besides traditional environmental problems, such as air pollution or improper waste management that cities must address, municipalities are also required to address global challenges (e.g., climate change) and, at the same time, are responsible for local social and economic concerns regarding job creation, health benefits, education, and proper transportation (Hideo Doll & Oliveira, 2015; McCormick, Anderberg, Coenen, & Neij, 2013). Climate policies and their development benefits can address these challenges as well. Co-benefits vary among the sectors and are divided into three categories: economic, environmental, and social (IPCC, 2014b). A typical economic co-benefit of many GHG reduction measures is the creation of jobs (Cai, Wang, Chen, & Wang, 2011; IPCC, 2014a, 2014b), while typical environmental co-benefit are the reduction of air-pollution (Friel et al., 2009), lower production of waste in a waste treatment project (de Nazelle et al., 2011 Mayrhofer & Gupta, 2016). Enhancing energy securement as a secondary outcome of climate policies in the energy sector is an example of social co-benefits (Mondal, Denich, & Vlek, 2010). Table 1 shows different types of co-benefits.

Studies have found large co-benefits for low-carbon investments in the transportation and waste sectors, particularly in cities (Geng et al., 2013; IPCC, 2014b; Kapshe, Kuriakose, Srivastava, & Surjan, 2013; Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008). In the transportation sector, GHG emissions and air pollution have a common source that also causes congestion, accidents, and noise. Addressing these problems at the same time will create the potential of large cost reductions, as well as the preservation of ecosystems and health improvements (Bickel, Friedrich, Burgess, & Fagiani, 2006; IPCC, 2007). Dirgahayani (2013) studied the impact of the new bus system in the city of Yogyakarta, Indonesia. He discovered that, over a lifetime of 15 years, the project avoided unnecessary trips and also remarkably reduced the amount of pollution. Calling this theme co-benefits, she urged the policy makers in midsize cities to implement the same type of transportation projects since they will meet growing demands in the future while also meeting climate targets. Another study shows that the policy to internalize the marginal social costs caused by the freight transport network in Belgium would cause the modal shift of trucking, rail, and inland waterway transport. Apart from the direct climate-change benefits that these projects incurred, energy consumption would be reduced by over 20% (Beuthe et al., 2002). In China and the US, as the studies show, the costs associated with the reduction of carbon emissions in transportation sector will be offset by the increase in health benefits (Aunan et al., 2004; Dong et al., 2015; Nemet et al., 2010; Thompson et al., 2014).

In the waste sector, the situation is similar. Menikpura, Sang-Arun and Bengtsson (2013), through an assessment on the possibilities to decrease waste and GHG emissions in the city of Bangkok, found that the benefits resulting from integrated solid waste management systems were far greater than the GHG mitigation itself. The recycled products

Table 1
Different types of co-benefits (IPCC, 2014b), page: 632.

Economic	Social	Environmental
Energy security	Health impact	Ecosystem impact
Employment impact	Energy/mobility access	Land-use competition
New business opportunities	Food security	Water use/quality
Productivity/competitiveness	Impact on local conflicts	Biodiversity conversation
Technological spillover/ innovation	Safety	Urban heat island effect
	Gender impact	Resource/material use impact