ARTICLE IN PRESS
JCIT-01537; No of Pages 9
Cities xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Cities

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

Research paper

Cities and climate change mitigation: Economic opportunities and governance challenges in Asia

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ARTICLE INFO

Article history:
Received 23 February 2015
Received in revised form 23 September 2015
Accepted 28 October 2015
Available online xxxx

Keywords:
Climate
Carbon
Mitigation
Cities
Governance
Asia

ABSTRACT

Cities are central to the fight against climate change, but the IPCC recently noted that many cities — and particularly those in the developing world — lack the institutional, financial and technical capacities needed to switch to low emission development paths. Based on detailed case studies of three Asian cities, this paper finds that the adoption of low emission development strategies (LEDS) at the urban level could be economically attractive. However, it also argues that without a coordinated multi-level, cross-sectoral governance framework these opportunities for low carbon urban development are likely to be left unexploited. As these governance conditions are frequently not in place, we argue that these case study cities, and cities in similar contexts, are likely to miss even the economically attractive low carbon development opportunities and become increasingly locked in to higher cost, higher carbon development paths. Due to their growing size and importance, we conclude that the presence or absence of governance arrangements that enable the adoption of low carbon development strategies in Asian cities will have global implications for climate change.

1. Introduction

Cities must be central to global climate change mitigation and the adoption of low emission development strategies (LEDS). Urban areas are home to more than half of the world's population, are responsible for around three quarters of global energy use and energy-related greenhouse gas emissions and are growing rapidly (Gouldson et al., 2015; IPCC, 2014; UN DESA, 2014; WHO, 2014). However, the IPCC (2014) reports that many cities, and particularly those in the developing world, lack the political will and the institutional and financial capacities needed to shift to more energy and carbon-efficient development paths.

Many authors have emphasised the role that new governance arrangements could play in enabling urban-level responses to climate change (Acuto, 2013; Betsil & Bulkely, 2006; Corfee-Morlot et al., 2009; Franzén, 2013; Matsumoto et al., 2014; OECD, 2010). There has been a particular interest in multi-level governance arrangements that might improve the fit and the interplay between actors and institutions at the global, national, regional and local levels (Gouldson et al., 2015; Matsumoto et al., 2014; Paavola, Gouldson, & Kluvankova-Oravska, 2009). Effective multi-level interactions across these scales are needed because urban action on climate change is partly determined by policies and mechanisms introduced at higher scales — city plans are often adopted to contribute to national climate mitigation strategies that are themselves established in response to international frameworks and agreements (Anguelovski & Carmin, 2011; Franzén, 2013; Schreurs, 2010).

Arguably, the cross-sectoral aspects of climate governance are equally important at the city scale. Although some authors have explored the potential for integrating climate policy goals into sectors such as energy, transport or housing at the national level (c.f. Adelle & Russel, 2013), there have been very few analyses of the need for such cross-sectoral coordination at the urban level. Without such coordination, climate policy may be left in the domain of relatively weak environment departments and overlooked by the frequently more powerful and better-resourced departments in municipal government. The 'mainstreaming' of climate goals into the key areas of urban policy is therefore critically important.

With the exception of China (c.f. Balme & Yi, 2014), Asian cities have been largely neglected in research on governance for climate mitigation. This is an important gap in light of Asia's immense importance to climate change mitigation efforts. Asia contributed 27% of global emissions in 2011, or 30% if emissions from land use change and forestry are included (WRI, 2014); moreover, its contribution to global emissions is expected to increase significantly in the coming years in both absolute and relative terms (IEA, 2013). The forecast increase in energy use and

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http://dx.doi.org/10.1016/j.cities.2015.10.010

carbon emissions from Asia largely relates to expected levels of economic and population growth that will be concentrated in urban centres. Cities in Asia are projected to absorb an additional billion people over the next twenty-five years, which will demand huge investment in housing, energy, transport and waste infrastructure (Puppim de Oliveira et al., 2013). These investments provide an opportunity to pursue aggressive urban LEDS — failing to take these opportunities will lead to further lock in to costly, carbon-intensive development modes. The urban planning decisions — or, in the many instances of unplanned or ungoverned urban development, the 'non-decisions' (Crenson, 1971) — made during this period are therefore critically important.

This paper explores the scope and options for urban LEDS in Asia by examining opportunities for low carbon development in three cities: Kolkata in India, Palembang in Indonesia and Johor Bahru in Malaysia. These case study cities are not necessarily representative — they were selected as they have been the focus of in-depth studies by the authors on the economic case for low carbon investment — but understanding trends and opportunities in these cities can generate insights that have a wider relevance, particularly for other cities that are in comparable development contexts or that are facing similar governance challenges within Asia. Key data for the three cities are provided in Table 1.

The paper is structured as follows. In the next section, we outline the methodology used to identify trends in energy use and carbon emissions and to evaluate the economic case for and potential impacts of low carbon investment at the urban level. We then introduce the three case studies. For each, we consider the relationship between different levels of governance in each country, current patterns in energy use and greenhouse gas (GHG) emissions, and the opportunities for cost effective low carbon investment. We also discuss the cross-sectoral nature of the challenge by highlighting the distribution of low carbon development opportunities across sectors. We then compare the findings for each city, and identify some of the barriers to the adoption of urban LEDS. This underpins a discussion about mechanisms to improve coordination across different levels of governance and to mainstream climate considerations into different spheres of policymaking. We conclude by reflecting on the importance of building multi-level, cross-sectoral climate governance frameworks if Asian cities are to adopt and pursue urban LEDS.

2. Cases, approach and methods

A common methodology was adopted across the three case studies. The methodology has three stages:

1. An assessment of trends in energy use and GHG emissions between 2000 and 2013 and of the implications of these trends continuing to 2025.
2. An analysis of the scope for economically attractive low carbon investments in the electricity sectors serving each city over the next decade (2015–2025), developed from a bottom-up evaluation of a wide range of low carbon electricity generation measures.
3. An analysis of the scope for economically attractive low carbon investments in different sectors over the next decade (2015–2025), developed from a bottom-up evaluation of a wide range of climate mitigation measures.

Table 1
Key statistics for the cities of Kolkata, Palembang and Johor Bahru in 2014.

	Kolkata, India	Palembang, Indonesia	Johor Bahru, Malaysia
Population	14.7 million	1.5 million	1.8 million
GDP per capita (USD)	2139	2940	14,790
Energy use per capita (kgoe)	243	861	2862
Emissions per capita (tCO_2-e)	1.69	1.98	11.55
Energy bill (% of GDP)	9.1%	18.7%	15.2%

Each of the studies considered energy use and emissions from the metropolitan area, including those from direct consumption of fuels and waste facilities within local authorities' reach (so-called Scope 1 emissions) and those produced while generating the electricity consumed within the city (Scope 2 emissions). The studies therefore took into account the energy mix, carbon intensity and the production and transmission efficiencies of electricity supply. Due to lack of data, none of the studies considered emissions from industrial processes (typically included in Scope 1). We also did not include embedded energy or carbon in the goods or services produced or consumed within the city (Scope 3 emissions) due to the methodological complexities highlighted by Macrotullio et al., (2012). Other research has found that accounting for embedded energy through consumption-based carbon accounts is likely to reduce the carbon footprint of producer and exporter cities and to increase the carbon footprint of consumer and importer cities (Satterthwaite, 2008; Hoornweg et al., 2011; Gouldson et al., 2015). The extent of the adjustments that would be required if embedded energy was taken into account is not clear, but due to the industrial and export-oriented nature of the economies within which our case study cities exist, it is likely our estimates of per capita emissions would be lower if Scope 3 emissions were included (Davis & Caldeira, 2010).

Trends in energy use and emissions between 2000 and 2013 were used to forecast trends to 2025. These projections assume that no additional climate and energy policies are introduced in this period, apart from planned investments in electricity generation, transmission and distribution, which are accounted for in the changing carbon intensity of electricity between 2015 and 2025. The studies therefore assume that growth in the different cities can continue in the near future as it has in the recent past: for example, we project a consistent relationship between growth in income per capita and rising levels of vehicle ownership and use. In practice, many cities might encounter structural limits to growth such as gridlock in the transport system.

Longlists of low carbon measures that could be adopted in the housing, non-domestic buildings, transport, industry and waste sectors were then prepared for each city through extensive reviews of the academic, policy and grey literatures.[1] These lists included measures for the household and non-residential buildings sectors including small-scale renewables, improved building standards and more energy efficient heating/cooling, lighting and appliances. For the transport sector they included measures such as enhanced provision of different forms of public and non-motorised transport and the adoption of more fuel-efficient vehicles. For industry, a wide range of energy efficiency measures was included and for the waste sector measures such as enhanced recycling and methane capture from landfill sites were considered. To turn these longlists into shortlists, a process of iterative participatory appraisal was utilised (see Fraser, Dougill, Mabee, Reed, & McAlpine, 2006) with stakeholder panels selecting the measures that were appropriate to local conditions in each of the three cities.[2]

Preliminary estimates of the lifetime costs and benefits (expressed as a net present value (NPV) calculation) of each shortlisted measure were then generated using estimates derived from the grey and academic literature on its technical and economic performance. This economic analysis considered only the private financial costs and benefits of deployment in each context, comprising lifetime capital, running and maintenance costs, compared with Business as Usual (BAU) practice. Again adopting a process of iterated participatory appraisal, these estimates were reviewed and refined by stakeholder groups to ensure that they were locally appropriate and as realistic and accurate as possible. We adopted a standard real interest rate of 5% and assumed an annual increase of 3% in real energy prices. Prices for measures were held constant (at 2014 levels) without taking technological learning in the low carbon sector into account, thereby making the

[1] The data sources used in the three studies are presented in Appendix A.
[2] Full lists of the participants in the stakeholder panels that were drawn on in each of the three cities are detailed in Appendix B.

Please cite this article as: Gouldson, A., et al., Cities and climate change mitigation: Economic opportunities and governance challenges in Asia, *Cities* (2015), http://dx.doi.org/10.1016/j.cities.2015.10.010