

## **H/CITIES AND CLIMATE CHANGE**

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### **1. Introduction**

We are living in an ‘urban millennium’ in which, for the first time in history, more than half of humanity will be residents of cities<sup>1</sup>. The world is urbanising rapidly. Rural populations are expected to contract from 2015 onwards and by 2030 a phenomenal 5 billion people will be living in cities. Much of the urban growth in the coming years will take place in developing regions of the world. Between 2000 and 2015, 65 million new urban dwellers are expected to be added annually, 93 per cent of these in developing countries<sup>2</sup>. Asia and Africa are set to urbanise fastest and are expected to have urban populations of 54.5 per cent and 53.5 per cent respectively by 2030<sup>3</sup>. By this time, over 80 per cent of Latin America’s population will be city-based<sup>4</sup>. In such an urbanised world, climate change will have its greatest impacts in cities as this is where human beings, economic assets, cultural heritage and life support systems are concentrated. It follows that cities should be a central, if not a principal, focus of efforts to mitigate and adapt to climate change and its consequences.

### **2. The Vulnerability of Cities to Climate Change**

Cities are directly affected by rising global temperatures induced by climate change and the consequent changes in weather patterns and sea levels. The increased incidence and severity of extreme weather events such as tropical cyclones, flooding, landslides, heatwaves and cold snaps will have severe consequences for cities and their inhabitants, not least because the geographical location of many of the world’s major urban settlements exposes them to hydro meteorological hazards.

Since ancient times, urban settlements have developed close to large bodies of water, including oceans<sup>5</sup>, and today many cities are located near coastlines<sup>6</sup>. Around 40 % of the world’s population lives less than 100 km from the sea, within reach of severe coastal storms<sup>7</sup>. 360 million urban dwellers worldwide live in coastal areas that are less than 10 metres about seal level<sup>8</sup>. Moreover, an increasing number of people are gravitating towards fast growing coastal cities. Indeed, 21 of the 33 cities which are projected to have a population of 8 million or more by 2015 are located in coastal zones<sup>9</sup>. At the same time, a global rise in sea level of 0.2-0.9m is expected by the year 2100, potentially exposing millions of people to the related effects<sup>10</sup>. If sea level rises by one meter, many coastal cities such as Buenos Aires, Rio de Janeiro, Jakarta, Lagos, Karachi, Mumbai and Kolkata, all ‘megacities’ with populations over 10 million, will be greatly threatened.

Forces of globalization continue to drive the sprawl of coastal cities that are often national, regional or global economic hubs. The concentration of wealth, infrastructure and people in cities inevitably attracts further investments and growth as well as new residents. However, urban growth, especially in developing countries, is rapid and largely uncontrolled thereby increasing the physical vulnerability of cities to the effects of natural disasters. Almost a billion urban residents now live in slums which are located in low lying coastal zones, flood prone plains and ravines which are vulnerable to flooding, landslides, storm

surges and other hazards. Cities in developing countries continue to spread into such hazardous locations in order to accommodate their poor residents unable to afford homes in safer areas<sup>11</sup>. In Africa, slum dwellers constitute no less than 70% of the urban population whilst in the rest of the developing world, a still shocking 50% live in slums<sup>12</sup>. Slum dwellers are most vulnerable to extreme weather related hazards as they lack the resources to cope with the impacts of climate change<sup>13</sup>.

Climate change will expose cities and their inhabitants to extreme weather hazards (flooding, tropical cyclones etc). The degradation of coastal ecosystems around the world by cities further exposes their inhabitants to hydrological hazards<sup>14</sup>. Rising temperatures will increase the risk of urban heat islands (and thus heat waves) affecting human health and productivity but also increasing energy consumption. Water supplies will be at risk of salinization, warming and evaporation due to higher temperatures. A rise in water tables is also expected, potentially reducing the safety of foundations of the urban built environment. Climate change will also have less dramatic and direct effects on cities. Already, climate change and the consequent extreme climatic variations has been identified as a factor causing rural populations in Africa to migrate to urban areas, thereby fuelling rapid and often uncontrolled urban growth<sup>15</sup>. In turn, this exacerbates other risk factors such as the spread of settlements into easily accessible yet hazardous locations and unsafe building practices.

### **3. Contribution of Cities to Climate change**

Whilst cities are threatened by the effects of climate change, they also contribute directly to global warming. Cities consume 80% of the world's energy and are responsible for 75% of CO<sub>2</sub> emissions that cause climate change<sup>16</sup>. Direct sources of greenhouse gas emissions in cities include energy generation, vehicles, industry and the burning of fossil fuels and biomass in households. Emissions from vehicles and transport equipment are rising at a rate of 2.5% each year, and contribute not only to CO<sub>2</sub> emissions, but also to local and regional pollution problems through the emission of carbon monoxide, lead, sulphur oxides and nitrogen oxides. The electrical energy for public lighting and transportation, and industrial, commercial and household consumption, is also a source of emissions. Industry is responsible for 43% of the global CO<sub>2</sub> emissions from fossil fuel combustion. As the world's urban population continues to increase rapidly, so to will the contribution of cities to climate change.

### **4. Strategies for Mitigation and Adaptation**

National governments and cities can address climate change either through measures that seek to curb the process (mitigation) or strategies that enhance capacity to cope with its anticipated effects (adaptation). A number of measures can be adopted at the city level to mitigate climate change through the reduction of greenhouse gas emissions. These include<sup>17</sup>:

- Renewable energy, cleaner production techniques and regulations to control industrial emissions;
- Energy efficient housing and construction, including simple measures such as solar water heating, adequate insulation, double glazed windows and improved architectural designs for heating or cooling;
- Strategies to reduce vehicle emissions and promote non-motorized transport;
- Localised, cleaner energy generation systems;
- Waste-to-energy conversion systems.

Successful examples of programmes to reduce CO<sub>2</sub> emissions are already available (see Box 1). Behavioural changes are fundamental for such emission reduction strategies to be effective. For example, to reduce emissions from the transport sector, it is necessary to encourage people to change their travel habits and opt for more sustainable modes<sup>18</sup>.

## BOX 1: City level successes in CO2 reductions

### **Clean Vehicles slash tons of CO2 annually, Stockholm, Sweden**

With a population of 775 000, Stockholm has the highest percentage of vehicles in Europe. Not only are the city's vehicles on the way to being 100% clean by 2010, but citizens of Stockholm are also going green at a fast rate, with 5% of all vehicles now either hybrid or using biofuels. The Clean Vehicles programme in Stockholm is committed to achieving 100% clean vehicles by 2010 and ensuring 80% of cars run on clean fuels. Critical to the success of this programme has been the expansion and enhancement of biofuels. The city government has also provided several incentives including free parking, removal of congestion charges and subsidies for cleaner vehicles. The national government offers tax discounts, to owners of clean vehicles and also provides grants to biogas stations. It is also mandatory for fuel stations to provide clean fuels. The programme has succeeded in reducing Stockholm's CO2 emissions by 200 000 tons a year.

### **Halfway to becoming fossil fuel free, Växjö Sweden**

Växjö is a city of 78 500 inhabitants. An incredible 51 per cent of Växjö's energy comes from sources such as biomass, renewable electricity, geothermal and solar energy sources. In little over a decade, emissions have been reduced by 24 per cent per person to 3.5 tons of CO2 annually, well below the European (8CO2t/a) and world (4CO2t/a) averages per annum. Since 1993 the city has been monitoring CO2 emissions closely. In 1996, a 'Fossil Fuel Free Växjö' policy was introduced with a commitment to reduce CO2 emissions per capita in heating, energy and transport by 50% by the year 2010 and by 70% by 2025. This policy incorporated a number of other measures including reduction of per capita electric energy use and an increase in the use of non-motorised and public modes of transport. The city is well ahead of its goals with these commitments, having achieved an average annual reduction of 4 951 tons of CO2 emissions in heating, electricity and transport between 1993 and 2005.

### **Gas emissions reduced by 40% through a Bus Rapid Transit System, Bogotá, Columbia**

Bogotá has a population of 6,981,500. The Bogotá Transmilenio System is a rapid bus transit system which consists of 850 buses and serves 1,400,000 passengers per day. The system has managed to reduce the city's gas emissions by 40%. It was initiated with a view to improving public transport, restricting private automobile use, expanding and improving bicycle paths and enhancing public space. The system operates 18 hours a day and has dedicated lanes, large capacity buses and elevated bus stations that allow pre-board ticketing and fast boarding. By 2012, the Transmilenio is expected to serve 1.8 million passengers.

### **Fuel-Substitution for Diesel-Fed Songteaws, Chiang Mai, Thailand**

Chiang Mai is the second largest city in Thailand with a population of 170 348. The city designed a master plan for improving air quality to be operational from 2000 to 2010. One of the highlights of this plan is the production and utilization of bio-diesel as alternative fuel for *songteaws*. *Songteaws* (converted pickup trucks) are the main public utility vehicles in the city, with 2 710 providing services to residents. A study in 2002 illustrated that the city's transportation sector accounted for 106 978 tons of CO2 emissions of which 27 169 tonnes came from *songteaws*. A pilot project involving 1 000 *songteaws* has produced annual carbon savings of 267 tonnes.

Source: C40 Cities: Climate Leadership Group, [www.C40cities.org](http://www.C40cities.org); ICLEI-Local Governments for Sustainability, [https://www.iclei.org/fileadmin/user\\_upload/documents/SEA/CCP\\_Projects/Chiang\\_Mai.pdf](https://www.iclei.org/fileadmin/user_upload/documents/SEA/CCP_Projects/Chiang_Mai.pdf)

In addition to curbing emissions, cities can pursue strategies to adapt to the effects of climate change, some of which are already underway. The expansion and growth of cities in particular should be managed with the risk of sea level rise in mind. For instance, land-use planning and building controls should consider the expected impacts of climate change<sup>19</sup>. Improving disaster risk reduction capacity (preparedness, response and recovery) is also fundamental in preparing cities to cope with the effects of climate change.

Such city level strategies need to be implemented with the support of national level policy and legislative frameworks. Governments can facilitate city level strategies by integrating climate change issues in national level policy and development strategies. In the absence of national policies or legislation, approaches to emission reduction at the sub national level may be non-existent or divergent.

Cities can learn from the experiences of climate change mitigation strategies implemented by other cities. In turn, experiences from the city level can feed into and inform global policies.<sup>20</sup> Cities should also work in partnership with international agencies and networks, such as the *Cities for Climate Protection (CCP)*<sup>21</sup> through which more than 800 local governments have committed to integrate climate change mitigation into their decision-making processes and the *C40 Cities: Climate Leadership Group*, a group of 18 of the world's largest cities working together to reduce green house gas emissions.<sup>22</sup>

## **5. Policy Challenges for National and Local Authorities to Tackle Climate change**

A key factor that hinders the development and implementation of climate change policies is the uncertainty in the assessment of potential risks of climate change and the costs of averting it<sup>23</sup>. This uncertainty creates differences in perceptions of the threats posed by climate change, how to tackle it and the urgency for action. Uncertainty makes it especially difficult to identify design targets for adaptation. Adaptation strategies require long time horizons, and are thus not popular with governments which tend to focus on shorter time frames<sup>24</sup>. A focus on adaptation now may be perceived as a commitment of scarce public resources to a threat which is not seen as imminent. Thus, climate change policy has so far focused largely on mitigation, despite the need for adaptation to climatic changes that are already underway<sup>25</sup>.

Affordability is a key factor determining the implementation of measures to mitigate climate change. Climate friendly technologies are not always cheap, or market friendly, and new technologies may not be developed at the required pace and scale, preventing their uptake by national governments and city authorities.<sup>26</sup> Balancing the current investment and economic growth needs and priorities of cities with longer term strategies to curb climate change trends is a particular concern for developing countries, but also for developed nations. The cost implications of adaptation strategies (including the reduction of CO2 emissions) are often too high for many developing countries. Thus, developing countries, and their cities, concerned with economic growth and poverty reduction may be reluctant to cut emissions.<sup>27</sup>

City level adaptation strategies should be both economically viable and not overly burdensome on the urban poor<sup>28</sup>. For instance, it is possible for government measures to encourage urbanization away from coastal locations to disproportionately affect inhabitants of informal settlements<sup>29</sup>. Furthermore, certain strategies, such as land use planning, may be met with resistance in coastal cities if they go against economic investment interests<sup>30</sup>.

A major challenge for cities relates to the rapid and uncontrolled expansion of informal settlements (slums) which are most vulnerable to the effects of climate change. Addressing the slum challenge will contribute significantly to reducing human vulnerability to the effects of climate change in cities. This is exacerbated by the lack of institutional and legislative capacity at the local government level in developing countries which limits the adoption and implementation of climate change priorities.

National governments may not be obliged to cut emissions given dissent and mistrust at the international level with regards to the climate change challenge. This is evident, for instance, in the case of the Kyoto protocol and the difficulty for countries to reach consensus on the modalities of its adoption and implementation<sup>31</sup>. The different interests and perspectives of developed and developing countries make it difficult for a consensus to be reached regarding cuts in carbon emissions, as illustrated most vividly by the stand-off between the US and China with regards to the Kyoto protocol<sup>32</sup>.

## **6. Conclusion**

A recent report of the Intergovernmental Panel of Climate Change (IPCC) has illustrated beyond doubt the scientific link between anthropogenic (human) greenhouse gas emissions and climate change<sup>33</sup>. The debate on climate change should thus focus less on questioning the human impacts on climate change, and more on the identification of appropriate mitigation and adaptive strategies. Cities are the main

contributors as well as potential victims of climate change and should thus be central to international, national and local level climate change policies.

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<sup>1</sup> UN-HABITAT, 2006a

<sup>2</sup> UN-HABITAT, 2006a

<sup>3</sup> *Ibid*

<sup>4</sup> *Ibid*

<sup>5</sup> Timmerman and White, 1997

<sup>6</sup> Sherbinin et al., 2007

<sup>7</sup> UN-Habitat, 2006b

<sup>8</sup> Sherbinin et al, 2007 ; McGranahan, 2007

<sup>9</sup> IPCC, 2001

<sup>10</sup> Warrick, R.A et al (1996) cited in Nicholls and Hoozemans (1996)

<sup>11</sup> Timmerman and White, 1997

<sup>12</sup> UN-Habitat, 2006b

<sup>13</sup> McGranahan et al, 2007

<sup>14</sup> Timmerman and White, 1997

<sup>15</sup> Barrios et al, 2006

<sup>16</sup> <http://www.c40cities.org/>

<sup>17</sup> UNEP and UN-Habitat, 2005; www. C40cities.org

<sup>18</sup> Chapman, 2007

<sup>19</sup> Timmerman and White, 1997

<sup>20</sup> UNEP and UN-Habitat, 2005

<sup>21</sup> <http://www.iclei.org/index.php?id=800>

<sup>22</sup> UNEP and UN-Habitat, 2005

<sup>23</sup> CBO, 2005

<sup>24</sup> Sherbinin et al, 2007

<sup>25</sup> Sherbinin et al, 2007

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<sup>26</sup> Zhang, 2007

<sup>27</sup> Zhang, 2007

<sup>28</sup> McGranahan et al, 2007

<sup>29</sup> Satterthwaite, 2006

<sup>30</sup> Nicholls and Hoozeman, 1996.

<sup>31</sup> Leopold, 2007

<sup>32</sup> Najam, 2003; Zhang, 2007

<sup>33</sup> IPCC, 2007

