

PROTECTING OUR CAPITAL

How climate adaptation
in cities creates a resilient
place for business

Based on the CDP responses
from 207 global cities

207 cities across
the globe are
taking the lead on
climate adaptation,
protecting
394,360,000
people from the
effects of climate
change and
creating **resilient**
places to do
business.



Foreword

CDP, C40 and AECOM are proud to present findings from an unprecedented number of cities disclosing their climate mitigation, adaptation and water management data. In 2014, 207 cities reported to CDP, an 88% increase since last year thanks to a groundbreaking grant from Bloomberg Philanthropies.

As a result, the data is clearer than ever before that cities are leading the way on climate change. In 2014, 108 cities reported their carbon emissions inventories. The cities of Denver (USA), London (UK), Madrid (Spain), Durban (South Africa) and Taipei (Taiwan) reduced their emissions by a total of 13.1 million tons CO₂ equivalent since 2009, a 12% reduction. Cities are also increasing their resilience to the impacts of climate change. This year, cities reported 757 adaptation activities and 102 cities have climate adaptation plans.

There is significant opportunity for collaboration between city governments and business to improve climate resilience. CDP's data shows there is also increased action across the private sector. Last year, a record number of financial institutions, representing \$92 trillion in assets, asked the companies they invest in to disclose their climate emissions, risks and actions, leading to greater management and accountability. In this report, we analyze data from cities and

companies to understand what impacts cities expect businesses could face from climate change and how greater climate resilience makes cities more attractive to business.

Cities are reducing the climate risks faced by citizens and businesses through investment in infrastructure and services and by developing policies and incentives that influence action by others. These efforts to understand and reduce climate risks improve the cities' economic competitiveness. The city of Oslo, for example, reports, "[w]e estimate Oslo is relatively resilient compared with other Norwegian cities. This could then make Oslo more attractive for business settlement."

The benefits that business brings to cities, including jobs, tax revenue and services, are one of the drivers for cities to improve their climate resilience. Similarly, businesses are reliant on public infrastructure and environmental policies to support and guide their operations. This report shows how cooperation between cities and businesses leads to better resilience city-wide. Both sectors can benefit from a greater understanding of each other's climate change risks, and companies can help reduce city-wide risks by embedding local adaptation needs within their business operations.

We congratulate the 207 cities that disclosed their environmental data to CDP this year and the significant impacts they have already made in tackling climate change. While this report focuses on how cities' actions create more attractive, resilient places for business, it is not the responsibility of cities alone to mitigate and adapt to climate change. This report provides cities with unprecedented information and insights into the physical risks businesses face locally and how their actions help reduce those risks. We hope this will support cities in their mission to create attractive places to work and live.

Fig 1 Map of selected business risks reported in cities

City adaptation actions protect physical and economic capital



San Diego USA

Company: Sempra Energy

Economic importance: Provides electricity to over 20 million customers in southern California. Employs 17,000 people worldwide⁵.

Climate risk: Drought

Impact: Electricity infrastructure at risk of wildfires resulting from drought and increased temperatures.

Company action: Sempra reports that the company conducts risk monitoring and water management across the river basin. Sempra's natural gas power plants are built to standards that minimize water use⁶.

City action: The city is delivering a water resources plan and urban water management plan to reduce water demand within the city and conserve water resources, which reduces the risk of wildfires. The city provides businesses with free water-usage surveys to identify opportunities for water efficiency in their business⁷.

Toronto* Canada



Company: Enbridge, Inc

Economic importance: Largest gas distributor in Canada

Climate risk: Frequent and intense rainfall

Impact: Water may enter pipelines and disrupt services or affect transmission; infrastructure near stream banks could require remediation. Multi-million dollar impacts expected if gas operations are disrupted.

Company action: Enbridge Inc reports that it has business mechanisms in place to recover costs of repairs.

City action: After being hit by a "once in a hundred years" storm in 2005, the city updated its 25 year "Wet Weather Flow Master Plan" with new priorities, including basement flood remediation and water source controls¹. The Plan was originally approved in 2003 and in its first five years, the city spent over \$90 million improving water management across the city.

Caieiras Brazil



Company: Sabesp

Economic importance: Semi-private provider of water and sewage utilities

Climate risk: Storms and floods

Impact: The company recognizes that climate change will cause increased flooding, which will impact their business.

Company action: Developed a corporate climate change adaptation plan. The company has jointly invested in a \$22 million fund to support research on new technologies to improve water and environmental management across the state of São Paulo, including energy efficiency and improved water distribution networks.

City action: The city is partnering with the national government to deliver a \$5.3 million project to increase the flow capacity of the Juquery River, which is responsible for local flooding.

(*) denotes a C40 city

Data on physical risks from climate change, their impacts and company actions was reported by the relevant company in response to the 2013 CDP Investor questionnaire, unless otherwise noted.

Data on climate change actions taken by cities was provided by the relevant city in response to the CDP Cities 2014 report, unless otherwise noted.

Lisbon Portugal



Company: Caixa Geral de Depósitos

Economic importance: Provide commercial and personal banking services across Portugal as well as four other countries

Climate risk: Temperature increase and heat waves

Impact: Increased energy demand could cost the company \$2.2million in increased fuel bills.

Company action: The bank has improved the energy efficiency of its buildings, and has reduced electricity consumption by 16% since 2010 despite rising temperatures.

City action: In partnership with the Local Energy Agency and other organizations, the city is identifying local impacts of the urban heat island effect and identifying solutions for businesses and residents. The city is also delivering a new Master Plan to regenerate the city center, which includes green infrastructure for water catchment and urban heat island mitigation.

Geoje South Korea



Company: Samsung Heavy Industries (SHI)

Economic importance: Employs over 13,000 people and builds the highest number of container ships per annum in the world².

Climate risk: Frequent and intense rainfall

Impact: Reduced operational hours at company shipyard resulting in delayed deliveries. Typhoon Maemi in 2003 caused approximately \$20 million in damages.

Company action: SHI conducts regular training and testing exercises for its early warning systems, costing the company \$41,000 per annum. The company spends approximately \$30,000 per annum on facility upgrades to maintain business continuity throughout heavy rainfall.

City action: In 2014, the city will be publishing its first Climate Adaptation Plan, and is already investing in infrastructure upgrades and new drainage systems. Geoje established a Green Growth Committee to help the city reduce emissions whilst promoting green business.

Hong Kong*



Company: CLP Holdings

Economic importance: One of two companies that generates energy in Hong Kong, supplying electricity to millions of Hong Kong residents and businesses.

Climate risk: Sea level rise

Impact: Damage to facilities and assets, interruption to power generation and supply.

Company action: CLP is raising the floor level of the buildings that house critical infrastructure in order to compensate for sea level rise, costing the business \$193,000. CLP invested \$516,000 to increase drainage capacity at its facilities.

City action: Hong Kong's drainage Services Department is investing \$2.7 billion in flood defence infrastructure, including underground storage tanks, river widening and large drainage tunnels⁴.

Melbourne* Australia



Company: Crown

Economic importance: A 24-hour casino that is the largest private-sector employer (6,500 jobs) in the state; contributes over \$2.8 billion in casino tax annually³.

Climate risk: Storms and floods

Impact: Property damage from extreme weather and loss of energy supply, relating to loss of capital and revenue.

Company action: Crown conducted a climate risk assessment and continually manages and upgrades its facilities for climate resilience and emergency response system. Crown invested \$71,000 on a back-up power system.

City action: Melbourne provides extreme weather management and warning systems, energy efficiency standards for large buildings and increased energy security through a renewable energy target and decentralised combined heat and power systems.

1 "Wet Weather Flow Master Plan, The Plan in Action: 5-Year Summary Report." *Livegreen Toronto*, 2009. http://www1.toronto.ca/city_of_toronto/toronto_water/files/pdf/wwfmp_5yr_implementation_report.pdf

2 "Geoje Shipyard." *Samsung Heavy Industries*, n.d. Web. 29 June 2014. <https://www.shi.samsung.co.kr/Eng/Pr/shipyard01.aspx>

3 "Crown Melbourne – Facts and Figures." *Crown Melbourne Ltd*, Sept 2010. https://www.crownmelbourne.com.au/Assets/Files/1_Media_Release_September_2010_Crown_Entertainment_Complex_Facts_Figures.pdf

4 Wilcox, Kevin. "Hong Kong Invests in Underground Flood Control." *Civil Engineering*, 25 Sept 2012. Web. 29 June 2014. <http://www.asce.org/CEMagazine/Article.aspx?id=25769811632#.U7A11ZQ7uSo>

5 "The Sempra Energy Story." *Sempra Energy*, n.d. Web. 29 June 2014. <http://www.sempra.com/about/>

6 "Achieving balance: 2013 Corporate Responsibility Report." *Sempra Energy*, 2014. Web. 29 June 2014. <http://issuu.com/sempraenergy/docs/crr2013/29?e=12419778/6338079>

7 "Water-Wise Business Survey Program." *City of San Diego*, n.d. Web. 29 June 2014. <http://www.sandiego.gov/water/consevation/waterwisebusiness.shtml>

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The vulnerability of major infrastructure for transportation and energy is an important factor for business development.”

Boston USA



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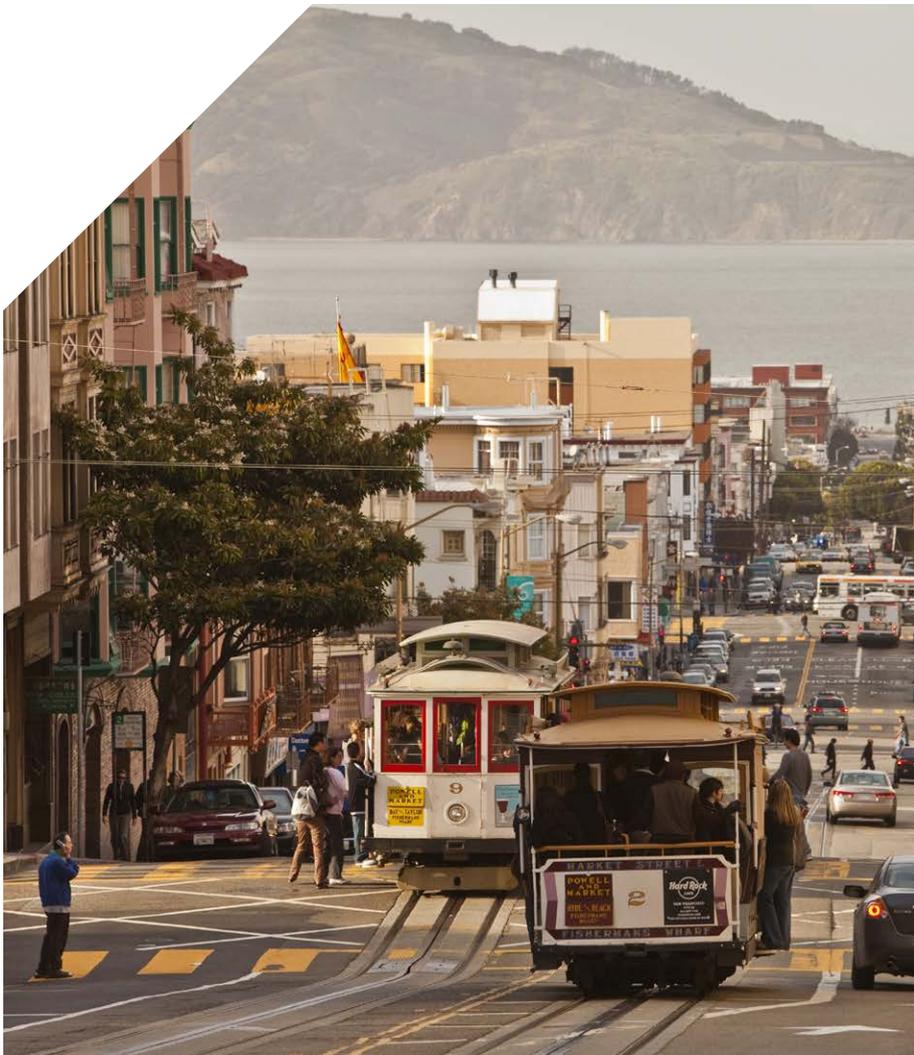
If sea level rise occurs, it will disrupt transportation systems that have immediate consequences for tourism and supply chains, causing lasting impacts.”

Abidjan Côte d'Ivoire





“ Development sectors are threatened by climate change: energy, agriculture, fisheries, infrastructure and health. These sectors could fail unless climate change is anticipated and responded to properly. ”
Jakarta Indonesia



“ If the built environment of San Francisco is not adapted to allow for dynamic environmental changes, then businesses will face a wide range of disruptions. ”
San Francisco USA

Fig 2 Climate actions and economic significance of cities

Proportion of global
GDP generated in cities

80%

Estimated value of assets at risk
from climate change by 2030

\$4tn

Number of climate adaptation
activities reported by 207
cities in 2014

757

Amount of emissions reduced
by Denver, London, Madrid,
Durban and Taipei, since 2009

13.1m
tons CO₂ equivalent

Proportion of cities reporting
that climate change could
impact business

76%





By taking ownership and addressing vulnerabilities to climate change, Las Vegas sets itself apart from other major cities as a business friendly environment. ”

Las Vegas USA

Introduction

In their latest report, the Intergovernmental Panel on Climate Change (IPCC) made clear that urban climate change risks are increasing⁸. With cities generating more than 80% of global GDP⁹ and housing more than 50% of the global population, the panel's conclusions are undisputed: this density of people and assets increases the concentration of risk from climate change in cities.

Without action, the economic costs of climate change are significant. By 2030, as much as \$4 trillion in accumulated costs is at risk from climate change around the world¹⁰. A recent report by the Asian Development Bank found that in East Asia, especially, the costs of climate change could exceed 5.3% GDP¹¹. In the United States alone, the recent report from Risky Business¹² calculated that the cost of climate change for business is billions of dollars, and likely to result in up to 5.9% reduction in economic output.

Cities have long been leading the charge to mitigate greenhouse gas emissions¹³. Driven by the increasing risks of rising global temperatures, cities are now emerging as a leading force for climate change adaptation. The steps cities are taking to improve their resilience lead to greater protection of the physical, economic, natural and human capital that define a city's key strengths.

This year, the number of cities that disclosed their climate change activities to CDP nearly doubled, from 110 cities in 2013 to 207 cities. Through this increased disclosure, we can see more clearly than ever before the critical role cities are already undertaking to mitigate climate change risks.

In this report, we focus on how the evolving role of cities to protect its citizens and economy lead to greater resiliency for business. We interrogate CDP's extensive database of climate change activities reported by over 200 cities and more than 4,500 large, listed companies to understand how action by city governments creates a resilient place for business.



The C40 Cities Climate Leadership Group (C40) is a network of the world's megacities taking action to reduce GHG emissions and climate risks. In 2014, C40 and CDP mark four years of partnership on efforts to engage cities in climate change data reporting. C40 Chair, Rio de Janeiro Mayor Eduardo Paes invited all C40 cities to participate through CDP's reporting platform – 61 cities responded. For more information, please visit www.c40.org.

A note on the text. All analysis and conclusions presented in this report derive from data reported to CDP, unless otherwise noted. All references to risks refer to physical risks from climate change, while impacts refer to the effects of these physical risks. Data reported by 207 city governments was provided in response to the CDP Cities 2014 questionnaire. Data reported by 78 companies that reported risks in cities was identified from a database of over 4,500 company responses to the CDP Investor 2013 questionnaire. All percentages are listed as a percentage of cities able to provide information on this subject. The number of cities responding ranged from 190–207. Currency figures are given in US dollars.

8 Field, C.B. et al. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." IPCC, 2014. Chapter 12. http://report.mitigation2014.org/drafts/final-draft-postplenary/ipcc_wg3_ar5_final-draft_postplenary_chapter12.pdf

9 V. Lall, Somik. "Planning, Connecting and Financing Cities – Now: Priorities for City Leaders." *The World Bank*, 2013. <http://documents.worldbank.org/curated/en/2013/01/17197253/planning-connecting-financing-cities-now-priorities-city-leaders>

10 "Climate Change Scenarios – Implications for Strategic Asset Allocation." *Mercer*, 2011. http://www.ifc.org/wps/wcm/connect/6b85a6804885569fba64fa6a6515bb18/ClimateChangeSurvey_Report.pdf?MOD=AJPERES

11 The Risky Business Project is a joint partnership of Bloomberg Philanthropies, the Paulson Institute, and TomKat Charitable Trust. Launched in October 2013, the Risky Business Project focuses on quantifying and publicizing the economic risks from the impacts of climate change. More on the project, including their recent report, can be found on their website: riskybusiness.org. Report citation: Gordon, Kate. "Risky Business: The Economic Risks of Climate Change in the United States." *Risky Business Project*, July 2014.

12 "The Economics of Climate Change in the Pacific." *The Asian Development Bank*, Nov 2013. <http://www.adb.org/sites/default/files/pub/2013/economics-climate-change-pacific.pdf>

13 Rosenzweig, Cynthia, et al. "Cities lead the way in climate-change action." *Nature*, 21 Oct 2010. Web. 29 June 2014. http://ccrun.org/sites/ccrun/files/attached_files/2010_Rosenzweig_etal_2.pdf



Our work on adaptation planning brings together citizens, academia, industry and the private sector to inform and support our plan. ”

Kaohsiung Taiwan

Key findings

1. Cities recognize climate change threats to business. 76% of cities report that climate change could impact business. Climate change in cities affects many business sectors, from shipping and food production to tourism and service industries.

2. Cities and businesses are aligned in their recognition of climate change risks. 75% of the most severe physical risks from climate change that businesses disclose are also recognized by the relevant city. There is broad agreement between cities and business about what climate change risks the city could face.

3. City government adaptation actions contribute to business resilience. By identifying climate change risks, cities are taking action and delivering initiatives to reduce the impacts of climate change city-wide. The cities’ actions also reduce 129 of the 194 risks reported by businesses. Cities are providing information, incentives and regulations that assist businesses to be more resilient to climate change. Other actions, including investments in infrastructure and services support better resilience for businesses and the wider community.

Fig 3 Impacts to businesses expected by cities
% of cities, category





Storms have become more severe, bringing losses for residents and businesses. Damage to transport infrastructure reduces workforce access and disrupts the supply chain. If this situation persists or gets worse, it may alienate new business.”

Belo Horizonte Brazil

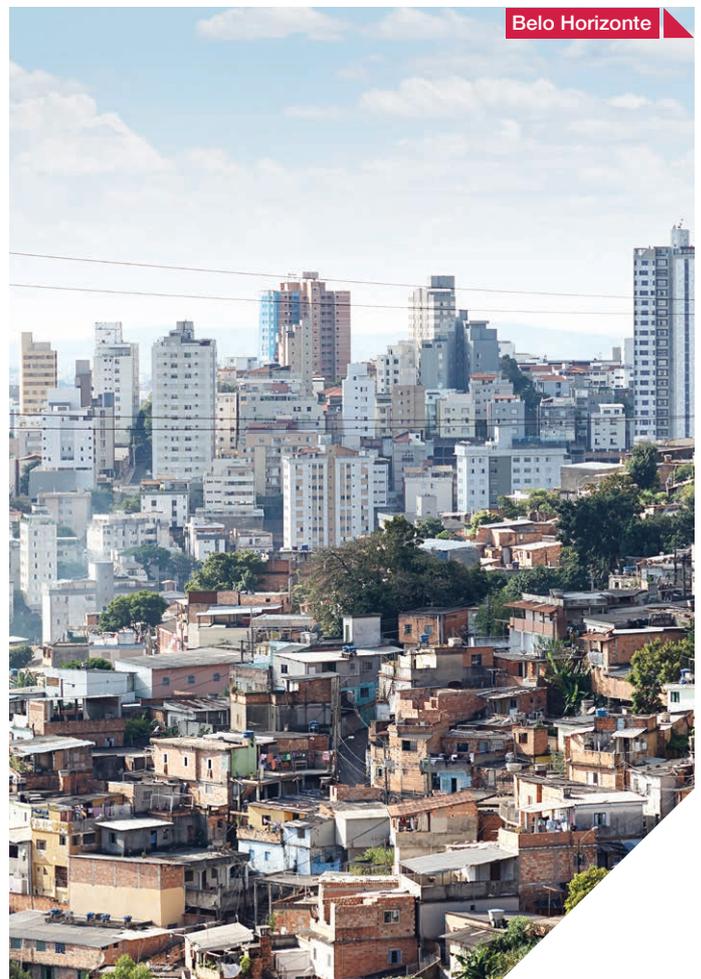
Climate change threatens business in cities

Consensus by cities is clear – climate change poses a threat to businesses within their municipality. In 2014, 76% of cities said climate change could impact the local private sector.

The impacts that cities expect businesses to encounter as a result of climate change are far-ranging. Damage to property, capital and non-transport infrastructure are commonly identified. Other reported impacts reveal a more complex challenge. For example, social impacts within the community, including impacts to public health, affect companies’ workforce and customers. Changes to the natural environment and available resources have impacts on production, particularly for food industries. As Figure 3 shows, impacts to property and capital, the surrounding community, availability of raw materials and non-transport infrastructure account for 50% of the risks cities expect businesses may face.

Data from cities shows that the impacts of climate change could affect a wide range of business sectors, including ports, food production, and service industries.

As gateways for the exchange of goods and services, more than half the world’s largest cities are ports¹⁴. The third largest port in Europe¹⁵, Hamburg, Germany, said that its port will be affected by climate change,



Belo Horizonte

and will be more expensive to maintain as a result. The city of Cleveland, USA, reports that the \$6.5 billion shipping industry in Lake Erie is also at risk from climate change. A “combination of increased frequency of large storms and lower lake levels could affect the city’s port operations,” the city noted. Sea level rise already affects not only the port of Seattle but also the city’s limited freight corridors. As a result, the city reports, “delivery of goods and services are frequently impacted by extreme weather.” Globally, the Organisation for Economic Cooperation and Development (OECD) found more than \$3 trillion in assets is at risk from climate change in port cities¹⁶.

¹⁴ Rosten, Eric. “Top 20 cities with Billions at risk from climate change.” *Bloomberg*, 6 July 2012. Web. 29 June 2014. <http://www.bloomberg.com/slideshow/2012-07-06/top-20-cities-with-billions-at-risk-from-climate-change.html#slide1>

¹⁵ “Port of Hamburg at a Glance.” *Hamburg Chamber of Commerce*, n.d. Web. 29 June 2014. <http://www.hk24.de/en/economic/347688/port.html>

¹⁶ Nicholls, R.J. “Ranking Port Cities with High Exposure and Vulnerability to Climate Change: Exposure Estimates.” *OECD Environmental Working Papers*, Nov 2008. <http://www.oecd-ilibrary.org/docserver/download/5kzssgshj742.pdf?expires=1404108311&id=id&cname=guest&checksum=2BBB210EA2E752EEE43F441AED4A38C>



More frequent and intense rainfall events induced by climate change may [flood] industrial complexes located in low lying areas and cause blackouts, potentially decreasing productivity. ”

Changwon South Korea

In many cities, the food and beverage industry contributes significantly to the local economy. The food industry in Bologna, Italy, for example, not only produces local products but also generates significant tourism, the city reports. In fact, the city is partnering with a high-end grocery chain to build a \$54.9 million food-themed park, which is expected to attract \$118 million revenue and create 5,000 new jobs¹⁷. The city reports that “severe weather patterns will negatively impact agricultural resources used to produce the symbolic foods of Bologna,” resulting in decreased production as well as higher prices, negatively impacting the residents’ access to food staples. In Campinas, Brazil, the food and beverage industry exported goods worth \$11 million in 2013¹⁸. The city reports that “industries requiring intensive water use, like soda companies, might choose another region due to water scarcity in the state of São Paulo.”

The finance and service industries in cities are affected by climate change threats including loss of utilities, building damage and rising operations costs. The city of Taipei, for example, reports that 80% of its workforce is employed in the service sector. The city also reports that the number of days with temperatures above 28° C is increasing, “resulting in business operating costs increasing from higher energy bills for air-

conditioning”. In Rio de Janeiro, the city reports that most of its finance and services industries are concentrated in the low-lying West Zone area, where, the city says, “[i]f sea levels rise by one meter, which could happen in the next decade, the entire area would be affected.”

While most cities report that rising global temperatures will lead to negative economic impacts, 79% of cities recognize that climate change creates new economic opportunities as well. Improvements in transport infrastructure, for example, can reduce greenhouse gas emissions and improve resilience to climate change. Research by Siemens suggests that the economic opportunity major cities could gain from upgrading their public transport infrastructure alone is around \$800 billion per year, due to productivity gains and the development of new economic activities¹⁹.

Improved energy efficiency can reduce energy bills and carbon emissions whilst improving energy security. Portland, for example, reports that it saves \$5.5 million annually through its City Energy Challenge, resulting in cumulative savings of \$42 million since the program’s inception in 1991. Investing in the resilience of energy, water and communication networks can have economic payback for cities and businesses alike.

¹⁷ Becker, Craig. “New Italian Theme Park will be ‘Disneyland of Food.” *Flight Network*, June 2014. Web. 29 June 2014. <http://www.flightnetwork.com/blog/new-italian-theme-park-will-disneyland-food/>

¹⁸ “Welcome to Campinas – The Most Amazing City of Brazil.” *Prefeitura de Campinas Tourism Department*, 2014. Web. 29 June 2014. http://www.campinas.sp.gov.br/arquivos/desenvolvimento-economico/guia_tur_eventos_ing.pdf

¹⁹ “The mobility opportunity: Improving public transport to drive economic growth.” *Siemens*, June 2014. <http://www.siemens.com/press/pool/de/feature/2014/infrastructure-cities/2014-06-mobility-opportunity/Study-mobility-opportunity-preview.pdf>



Copenhagen

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Instantaneous events such as flooding will decrease the ability of businesses to operate due to closed roads and damages to buildings.”

Copenhagen Denmark

“

Reduced rains increase the cost of food and other agricultural materials, thus making cost of production and living very high, and by extension, the cost of business high, too.”

Nairobi Kenya



Nairobi

“

Drinking water and electricity generation could be interrupted because of climate change. These factors could affect the private sector. Floods can interrupt operations and insurance companies may face higher claims.”

Caracas Venezuela

“

The urban heat island effect will drive up demand for cooling with consequent impact on energy supply and prices, potentially affecting business operations. It may also impact productivity in some businesses.”

Manchester UK



As a major financial center, there is synergy for Singapore to develop capability in climate risk management so that the insurance sector can be better informed of regional climate risks.”

Singapore

Cities and businesses identify similar climate change risks

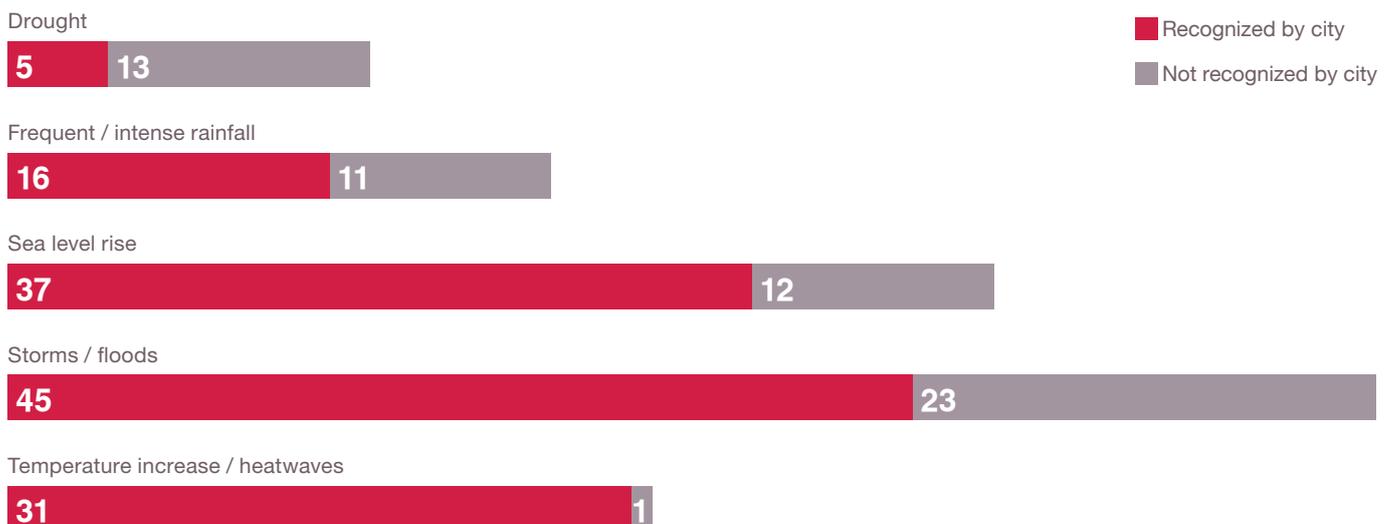
The remainder of this report presents findings from a sub-set of 50 cities in which businesses report they are facing risks as a result of climate change. Across these cities, 78 companies report 194 risks from climate change that could affect their business operations and profits within the city. The relevant city governments recognize 69% of these risks in their disclosure to CDP.

As the chart below shows, cities and companies are most aligned in recognizing risks from increased temperatures and heatwaves, which have immediate impacts across the public and private sectors. For companies, temperature increases lead to higher utility bills, retrofitting costs and potential production losses. Morgan Stanley, for example, reported spending \$4.4 million

to upgrade the air-conditioning systems at its data center to cope with rising temperatures in London. For city governments, changing temperatures directly impact human health, air quality and demand for utilities. The City of Philadelphia, for example, found that by taking steps to reduce the health impacts of temperature increases, it was able to save \$468 million in economic value over a three-year period²⁰.

While cities and companies are well aligned in their recognition of local risks, there is some variation in their reporting of the associated severity and timing of those risks. This is likely due to their different functions, priorities, vulnerabilities and adaptive capacities, which influence their assessments of climate change risks.

Fig 4 Risks reported by companies and recognized by cities
of risks reported by companies, category



²⁰ Ebi, KL et al. "Heat watch/warning systems save lives: estimated costs and benefits for Philadelphia 1995–1998." *Bulletin of the American Meteorological Society* 14.5 (2004).

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Our goal is to understand and manage climate risks. Cities that develop reasonable risk assessment and reduction strategies will be better positioned to attract and retain business.”

Toronto Canada

Analysis of the timescales over which companies and cities expect risks to take effect shows that they are not commonly aligned on this issue. The timescales of risks reported by cities and companies were classified as either current, short-term (expected within the next 10 years) and medium- to long-term (expected to take effect after the next 10 years). In only 26% of cases does the relevant city expect the risk to take effect within the same timeframe as the business.

There are a number of reasons why different organizations can expect the same risk to take effect in different timeframes. In Paris, for example, the real estate investor Gecina conducted a risk assessment of its buildings in the city and identified that heatwaves are increasing in frequency. As a result, the company conducted a detailed study to understand whether its air conditioning equipment has the capacity to deal with these increasing heatwaves. Gecina reports that rising temperatures will not impact its business for another 10 years or more. The city of Paris, however, reports that the August 2003 heatwave caused over 1,000 deaths and that temperature increases and heatwaves are a current risk. Gecina assesses the climate risk in terms of when it will impact its tangible assets, whereas the city assesses the risk in terms of when it will impact its citizens.

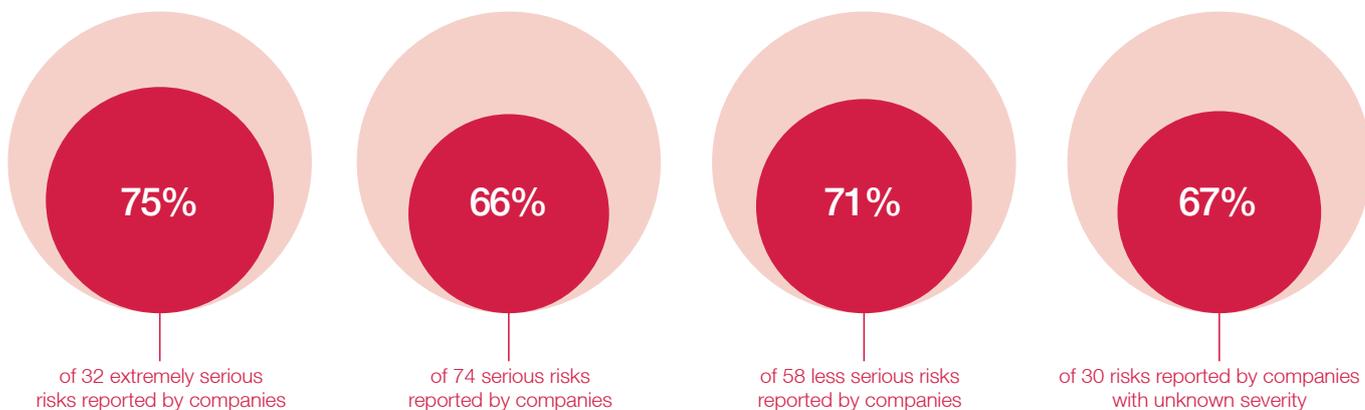
Analysis of the severity of risks that are reported by businesses and cities shows that in some instances there is good alignment. For example, two companies, Hitachi and Lite-On Technology identified frequent and intense rainfall as an extremely serious risk to doing business in Bangkok. Both companies reported that they had to shut down their factories for over a month when the city



flooded in 2011, and reported a combined loss of nearly \$96 million as a result. The city of Bangkok also categorizes climate change risks from flooding as extremely serious, forecasting that the economic damage from flooding could rise four-fold.

However, 72% of risks reported by businesses have a different level of severity for the city government. In Houston, for example, both Chevron and the city recognize that climate change presents risks from storms and flooding, but assess the severity of this risk differently. For Chevron, the risk to their operations in the city itself is less serious, meaning it would have a lower impact to the business as a whole. “Landfall of a major hurricane in key population centers such as Houston may cause disruption of office

Fig 5 Alignment in severity of risks reported by companies and recognized by cities
 % company risks recognized by cities, severity



based support activities,” writes Chevron. The city of Houston, however, considers the risk of storms and flooding from a different perspective and reports the risk as extremely serious, saying, “increased risk of storm surges cause flooding, property damage, and power outages, as well as interfering with telecommunication, destroying habitats and adversely affecting human health.” The degree of impact from storms and flooding, as well as other climate change risks, can vary between companies operating in the same area. For this reason, it may be helpful for cities to have an understanding of the degree of impact local businesses will face from climate change, but it is not the only factor in a city’s overall assessment of that risk to the city as whole.

The private and public sectors are unlikely to align in their assessments of the severity and timescale of risks. However, our analysis shows that such alignment is unnecessary for a city risk assessment. What is significant is that cities are identifying the same climate change risks that companies report as posing an extremely serious threat to their business. Analysis shows that cities recognize 75% of the extremely serious risks reported by companies.

As discussed in the next section, cities are taking adaptation actions that reduce climate risks. Where the city recognizes the same risk as a business, in 96% of cases the city is taking action to mitigate that risk city-wide. In every case where a city has identified a risk that the business assessed as extremely serious, the city is taking action that reduces that risk.

Further collaboration between cities and business could help ensure both parties fully identify and manage risks from climate change. Currently, 31% of the risks reported by businesses are not recognized by cities. A business’s risks from climate change are unlikely to apply to that business alone. Disclosure of private sector risks can help cities identify potential climate change impacts on the broader economy and the health and wealth of its citizens. Through reporting to the CDP platform, cities and businesses disclose and disseminate environmental data, which can help facilitate cooperation between the sectors and drive shared understanding.

EXPERT INSIGHT

Speaking the same language, driving climate action in cities

Kathryn Vines, Network Manager, Climate Change Risk Assessment, C40 Cities Climate Leadership Group (C40)

The risks of climate change impacts are an issue of growing importance to C40's global network of cities. Under the leadership of C40 Chair, Rio de Janeiro Mayor Eduardo Paes, adapting to climate change risks is a strategic area of focus. Ninety-eight percent of C40 cities report climate change presents a significant risk to their city. Over the last two years, the percent of C40 cities carrying out climate change risk assessments has increased from 62% to 79%.

C40 cities have the ability to reduce many of the climate risks that they face: mayors exercise strong powers over a wide range of assets and functions relevant to climate change adaptation. However, for a city to adapt effectively to climate change, all aspects of the city must adapt – city administration, businesses, community and surrounding regions – and they will benefit from doing so in a coordinated manner, engaging all stakeholders.

While mayors have strong powers in adapting their own systems and assets, and coordinating or influencing the actions of others, C40 cities nonetheless face challenges and limitations. Access to funding and technical expertise, institutional mechanisms and lack of information continue to be constraints to progress.

There is great potential for cities to share knowledge and experiences to accelerate climate action on this front. However, cities lack of common language to discuss climate

change hazards such as flooding or heatwaves. Combined with the highly contextual nature of climate change adaptation, in terms of geography, wealth and demographics, makes it difficult for cities to collectively identify and implement solutions, thereby accelerating action.

C40's Research and Networks programs are working with leading member cities to understand their climate change risks and take adaptation action. C40 works with CDP to provide a common platform for reporting climate risk and adaptation actions. In a major new initiative, C40 is developing a Climate Change Risk Assessment Framework and Tool (CRAFT) that

will include a globally consistent taxonomy of city climate hazards to improve communication between global cities as well as to local stakeholders such as businesses, many of which operate across geographies. Establishing a common language with cities will allow them to share challenges, opportunities and best practices, and provide a platform for joint problem-solving. CRAFT will improve, accelerate and transform local adaptation and drive global collaboration by tracking hazards from changing climate, their implications for cities and city action.

Alongside this research work, C40 convenes three active

city networks focused on climate change adaptation. Our Connecting Delta Cities Network focuses on spatial development, water management, and adaptation to support delta cities. The Cool Cities Network aims to mitigate the urban heat island effect by increasing the solar reflectance of buildings and pavements. Finally, the Climate Risk Assessment Network is working with cities to build climate resilient cities through best practice understanding and prioritization of climate change risks. C40 cities have already delivered more than 2,000 thousand adaptation actions – and with support from C40, will continue to create resilient cities and a less risky climate future.*



Photo © Juao Paulo Engeltbrecht

C40 Chair, Rio de Janeiro Mayor Eduardo Paes has initiated a major new project that involves macro-drainage, a component of which is the construction of this tunnel to divert part of the Joana River that is often responsible for heavy flooding.

* Please see C40's Climate Action in Megacities 2.0 for information on a broader set of adaptation and resilience actions across C40 cities (hyperlink on "Climate Action in Megacities 2.0" <http://c40.org/research>)

“

The need to create climate resilient infrastructure has opened the discussion about leveraging private sector funds to invest in municipal infrastructure through public/private partnerships.”

Los Angeles USA

“

The City is carrying out a project in partnership with local energy companies to install over 160,000 solar water heaters, this project will promote local manufacturing and provide a valuable source of income for smaller businesses.”

Cape Town South Africa

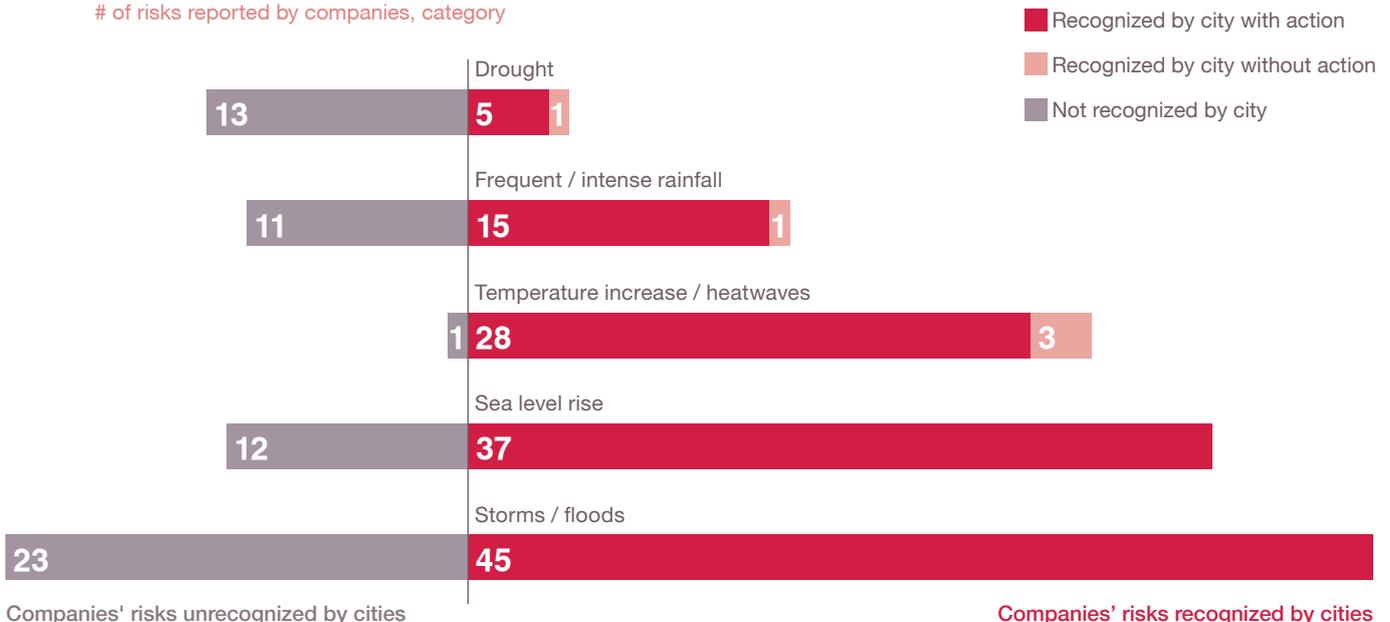
City-led adaptation actions contribute to business resilience

Cities seek to provide an environment that is attractive to business and residents alike. Physical capital, such as infrastructure and public transport, as well as human capital, including education and healthcare, are two major drivers for growth – but resilience to climate change is now a growing factor for cities’ economic competitiveness²¹. The impacts of climate change are increasing and the implications for cities and their role in reducing risks is already taking shape. In the United States, for example, an insurance company filed a lawsuit against city and municipal governments for not taking enough

action to reduce the impacts of climate change. The lawsuit was dropped in less than two months, but did raise awareness about the need to prepare for climate change²².

Our analysis, however, shows that cities are already managing the risks from climate change for their citizens and businesses. The 50 cities in which businesses report climate change risks are delivering a total of 295 adaptation actions. The data shows that these actions reduce 66% of the risks businesses also face within the city.

Fig 6 Number of company-reported risks reduced by city actions
of risks reported by companies, category



²¹ “Hotspots 2025: Benchmarking the future competitiveness of cities.” *The Economist Intelligence Unit*, 2013. Web. 29 June 2014. <http://www.citigroup.com/citi/citiforcities/pdfs/hotspots2025.pdf>

²² Roach, John. “Insurer’s message: Prepare for climate change or get sued.” *NBC News*, June 2014. Web. 29 June 2014. <http://www.nbcnews.com/science/environment/insurers-message-prepare-climate-change-or-get-sued-n122856>

“

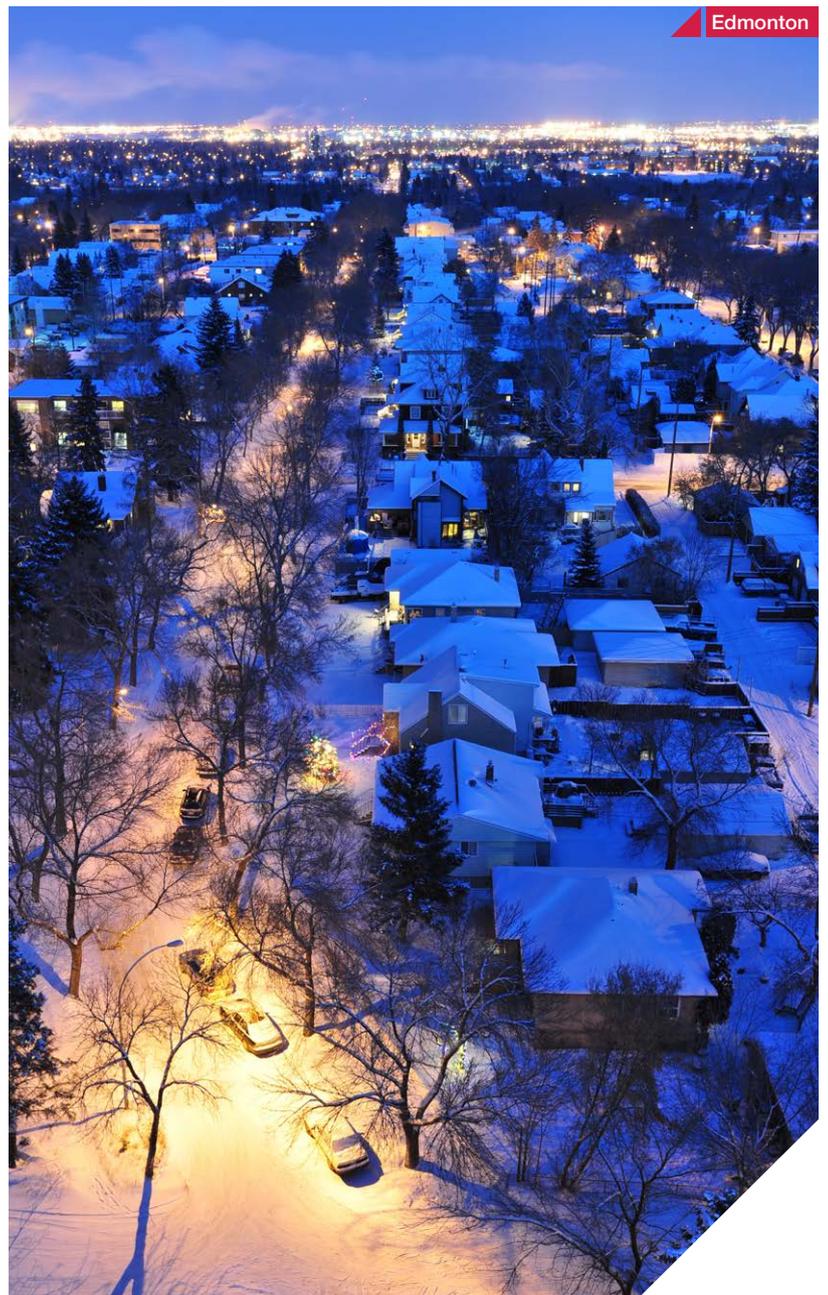
Financial incentives might help [drive action on climate change] but the city realizes that this cannot be the only means, and is looking to bylaws, land use zoning, building approvals, education, and leading by example.”

Edmonton Canada

There are a number of ways cities can support increased community-wide resilience with benefits to both businesses and residents. These options fall within two categories:

- **Investing directly in climate resilience:** Cities are delivering flood management plans, emergency response systems and targeted projects to protect the most vulnerable populations. They are also investing millions of dollars to upgrade key infrastructure such as transport to better mitigate the impacts of climate change.
- **Enabling business to adapt effectively:** Cities also provide information, policies, regulations and incentives that enable businesses themselves to take action to adapt and manage their own risks. These frameworks drive greater coordination between cities and businesses to reduce the impacts of climate change city-wide.

The following examples show profiles of climate change risks, which are reported by companies in four major economic centers²³ and the different approaches cities can take to reduce the impacts of these risks. In each example, the steps taken by the city improve the climate resilience of the highlighted company as well as the city’s population and economy as a whole.



²³ All four cities are also members of the C40 Climate Leadership Group.

London: Using its planning system to improve buildings' climate resilience



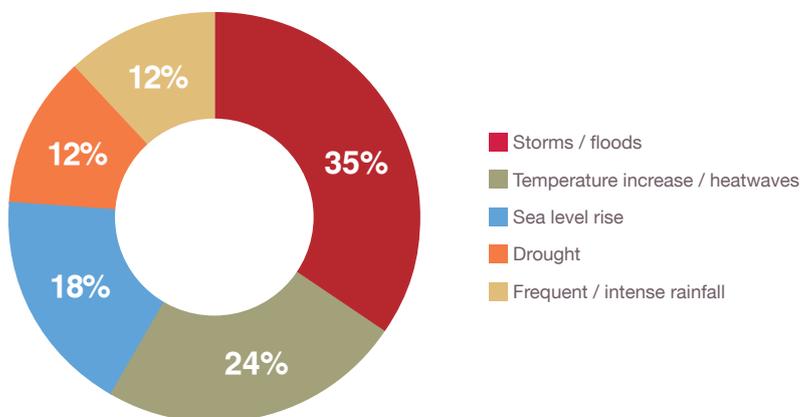
The design and density of cities often compounds the effects of rising temperatures caused by climate change. The result is urban heat islands, which affect air quality, human health and energy use. Urban heat islands are self-perpetuating, generating an increased demand for air-conditioning in buildings, which in turn releases heat into the air outside, continuing the warming cycle throughout the night²⁴.

London uses its planning system to ensure new buildings reduce their contribution and exposure to rising temperatures. The city's planning policy requires new developments to follow an energy hierarchy, in which energy efficiency is prioritized through building design. The Greater London Authority invests \$188,000 a year²⁵ to provide property developers with consultancy support to implement energy policies, in addition to providing tools to help businesses create green roofs and walls. These mechanisms not only reduce the energy consumption of

the buildings but result in better capacity to manage heat, without air conditioning.

Great Portland Estates is a property investor with a portfolio of 44 buildings, primarily for business use, across London²⁶. In 2013, the company reported that periods of high temperature could result in; intensive use of air conditioning, increased energy bills and "increased operational costs from the inability of building management systems to cope with extreme temperatures." To improve their business's resilience to this risk, the company reports that they are "designing buildings which include passive cooling methods and natural shading to reduce solar gain." Moreover, as advocated by the city government's energy hierarchy, Great Portland Estates installs "on-site generation of renewable energy...and energy efficiency systems." This demonstrates that London's climate change policies ensure businesses take actions that reduce their climate change impacts and risks.

Fig 7 Risks expected by businesses in London
% risks reported by companies, category



“ [London] applies the energy hierarchy, particularly to new development: to be lean (use less energy); to be clean (supply energy efficiently); and to be green (use renewable energy). ”
London UK

24 Salamanca, F., et al. "Anthropogenic heating of the urban environment due to air conditioning." *Journal of Geophysical Research: Atmospheres*. 119.10 (2014): 5949–5965. <http://onlinelibrary.wiley.com/doi/10.1002/2013JD021225/full>

25 "Procurement of Energy Assessment Consultancy Support for 1st April 2014 to 30th March 2018: Greater London Authority Investment and Performance Board." *Greater London Authority*, Jan 2014. <http://www.london.gov.uk/moderngov/documents/s32750/11%20Energy%20Assesment%20Consultancy%20Support%20cover%20paper.pdf>

26 "Portfolio." *Great Portland Estates*, n.d. Web. 29 June 2014. <http://www.gpe.co.uk/property/our-portfolio/all-properties.aspx>

Singapore: Providing information and guidelines to enable responsible action

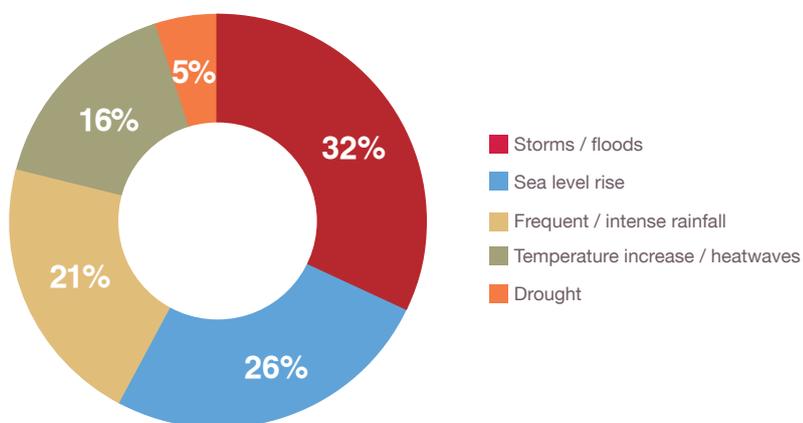


Rising sea levels due to climate change pose a risk to businesses operating in Singapore. Eni SpA reports, “[r]ising sea levels are likely to lead to direct losses, such as equipment damage from flooding or erosion, and indirect effects, such as raising vulnerable assets to higher levels or building new facilities farther inland, increasing transportation costs.”

By setting and maintaining standards as well as providing detailed information on precise risks and impacts, Singapore is creating a stable regulatory environment that boosts investor confidence. Moreover, its actions diminish the negative impacts and associated costs of sea level rise for private sector organizations.

Singapore is taking actions that reduce this significant risk and support the city’s continued economic and population growth. To protect new homes and businesses, Singapore sets minimum levels for reclaimed land. Since 1991, this minimum was set at 1.5 meters, but in anticipation of rising sea levels, in 2012 the city raised the minimum standard to 2.25 meters. The city also commissioned a Risk Map Study, covering the whole of the city’s coastline, to identify specific areas at risk from sea level rise and quantify the potential impacts.²⁷

Fig 8 Risks expected by businesses in Singapore
% risks reported by companies, category



“Singapore is improving its resilience to floods by investing in large scale water drainage improvements; traditional improvements are no longer viable, so the city is innovating to protect its citizens and businesses.”
Singapore Republic of Singapore

²⁷ “Climate Change and Singapore: Challenges, Opportunities, Partnerships.” *National Climate Change Secretariat, Prime Minister’s Officer Singapore*, n.d. Web. June 29 2014. <http://app.nccs.gov.sg/nccs-2012/preparing-singapore-areas-of-work-in-progress.html?AspxAutoDetectCookieSupport=1>

New York City: Providing incentives to encourage business action



Storms and flooding dominate the climate change risks reported by companies in New York City. Hurricane Sandy led to economic losses of over \$11 billion in the city.²⁸ Based on their 2013 report to CDP, the impacts to Thomson Reuters' New York operations were:

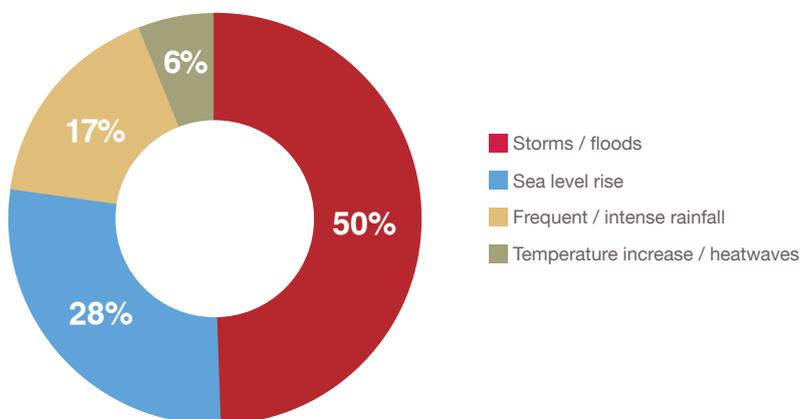
- Closure of their New York City data center
- \$50,000 extra fuel costs incurred at one data center, which had to run solely on power from a backup diesel generator for 72 hours while public services were restored
- Fuel spills at office locations in the city
- \$5 million incurred costs from damage claims and extra expenses
- Displacement of 5,000 employees and incurrence of approximately 3,000 hours of additional staff time to maintain business continuity, resulting in extra operating costs

- Inability of suppliers to furnish goods and services; inability of customers to receive and pay for services.

"We were fortunate that our revenues and reputation were not adversely affected," the company reported.

Following Sandy, New York City government allocated \$293 million in funding to help businesses in the city improve their climate resilience. This fund is mostly for the benefit of small and medium enterprises (SMEs) who represent 95% of the businesses affected by the storm²⁹. The city developed a comprehensive plan³⁰ for rebuilding the communities impacted by Sandy and increasing the resilience of infrastructure and buildings city-wide. For example, the city uses its regulatory powers to hold telecommunications providers accountable for climate resiliency and to strengthen building codes to ensure new buildings are climate-ready.

Fig 9 Risks expected by businesses in New York
% risks reported by companies, category



“The ability of businesses to operate successfully could be impacted by climate change if critical infrastructure components were impacted, resulting in power outages or transportation delays.”
New York City USA

²⁸ Zandi, Mark. "The Economic Impact of Sandy." *Moody's Analytics Webinar*, 1 Nov, 2012. Web. 29 June 2014. https://www.moody.com/PublishingImages/MCO/ProductAttachments/Econ_Impact_of_Sandy.pdf

²⁹ "The City of New York Community Development Block Grant – Disaster Recovery Partial Action Plan A." *New York City*, May, 2013. http://www.nyc.gov/html/recovery/downloads/pdf/nyc_cdbg-dr_action_plan_hud_submission.pdf

³⁰ "A Stronger, More Resilient New York." *New York City*, June 2013. <http://www.nyc.gov/html/sirr/html/report/report.shtml>

São Paulo: Investing in infrastructure to improve climate resilience

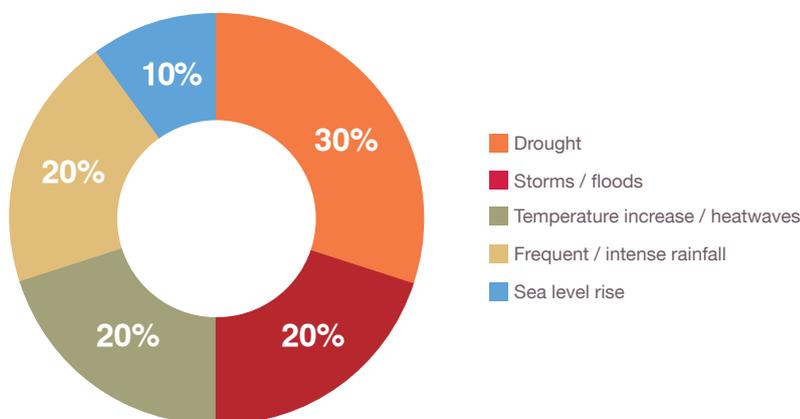


More than 80% of the population in Brazil lives in cities. Even in a nation of cities, however, São Paulo is a giant; it is the largest city by population in the southern hemisphere. As an emerging economy, climate change compounds the challenges already faced by the city.

The city takes a robust approach to improving resilience, from managing land-use to creating new urban greenspaces and building flood-defenses. Much of the city's climate activities, however, focus on improving the accessibility and resilience of its infrastructure. For example, the city is investing \$22 billion to improve its transport infrastructure³¹. Such investments have the potential to create improved conditions for business to operate, such as increased mobility of business staff and customers, and more efficient movement of supplies and products.

The city is also collaborating with large companies to improve its water infrastructure. The health impacts of poor sanitation are exacerbated by climate change³². Sabesp, the largest water company in the country and part-owned by the state, partnered with the city of São Paulo to deliver Programa Vida Nova. The program invested \$600 million³³ to provide sewage networks to 43 slums and poor developments in the city, in coordination with the city's slum urbanization program³⁴. Collaboration between cities and businesses is essential to reduce the impacts to the most vulnerable populations.

Fig 10 Risks expected by businesses in São Paulo
% risks reported by companies, category



“During extreme weather events like heavy rains and storms, there has been an increase in floods which negatively impact some of the most important highways in the city center, increasing traffic jams and putting pressure on the public transportation system. Strong storms also impact energy supply, causing blackouts.”
São Paulo Brazil

31 Endo, Mauricio. “São Paulo: keeping transportation megaprojects on the rails.” *KPMG INSIGHT Magazine*, n.d. Web. 29 June 2014. <http://www.kpmg.com/global/en/issuesandinsights/articlespublications/insight-magazine/pages/sao-paulo.aspx>

33 “Programa Vida Nova.” *YouTube*. Sabesp Cia, Dec, 2009. Web. 29 June 2014. https://www.youtube.com/watch?v=Q9cbZvQ_fqA

34 Sabesp website, n.d. Web. 29 June 2014. <http://site.sabesp.com.br>

32 “Building adaptation to climate change in health in least developed countries through resilient water, sanitation and hygiene (WASH).” *World Health Organisation*, n.d. Web. 29 June 2014. <http://www.who.int/globalchange/projects/wash/en/>

EXPERT INSIGHT

Financing resilient infrastructure

Gary Lawrence, Chief Sustainability Officer and Alexander Quinn, Director of Sustainable Economics, AECOM

There is no denying that investments in mitigation, resilience and adaptation come with high opportunity costs. There are many ways that the private and public sector can invest to improve their value and economic benefit. Every time one invests to address something that “might” happen there is less money available to address what does happen if the future turns out differently than anticipated.

The issue of capital and operating outlays within cities is compounded by the reality that most have no accumulated replacement reserves for existing infrastructure. When weather events occur it is often the case that existing facilities need to be refurbished and upgraded at the same time as new infrastructure is required.

Public and private capital funding for improving the resilience of replacement infrastructure while making investments that accommodate changing risks requires different considerations

regarding risk, asset value and return on investment. Improvements need to be about both creating value and avoiding costs for human health, business continuity, mobility and access of critical goods and services, etc.

There are three questions assumed in every mitigation and resilience investment:

- Is it technically feasible?
- Is it economically viable?
- Is it politically acceptable?

Finding the right balance, and improving each of the variables, is the key to rational allocation of resources for infrastructure in an uncertain future. Along with this is design for adaptation so that deployed assets keep their value when conditions change.

Understanding where to retreat can be just as important as

knowing when to hold the line. This requires a thoughtful/whole-systems benefit-cost evaluation method that internalizes the costs of community disruption, economic displacement, and environmental deterioration against the benefits of urban regeneration, ecosystem enhancements, and employment generation. Not all retreats need to be bad and can lead to smart value capture financing mechanisms that incentivize natural multi-benefit resiliency investments tied to increased development in the safer parts of our cities. They serve the dual purpose of growing where it makes the most sense while incentivizing divestments of assets most vulnerable.

To initiate preemptive action, it will be incumbent on each city to clearly communicate

Whole systems

A comprehensive view of infrastructure includes green and social infrastructure, which are keys to building long-lasting urban resilience.

the consequences of doing nothing and how meaningful investments can provide current and future community benefits. While the costs are significant, there are a number of financing mechanisms available to cities, such as transfer of development rights, increment financing, community benefit districts, and other special assessments that can be deployed to fund lasting mitigation measures. Financing will need to originate from both the private and public sectors with each side playing an equally important role in mitigating risks if our cities hope to withstand the incoming salvo of climate change.

Investment

To get projects moving, cities will likely need financing that originates from both the private and public sectors.



Conclusion

Adapting to the impacts of climate change is critical to the success of cities, businesses and local economies. The impacts cities and businesses face as a result of climate change have far-reaching implications, and neither sector can afford to be reactive. Our analysis shows that cities are delivering climate adaptation actions that not only help reduce risk in their communities, but also provide the co-benefit of helping businesses thrive.

Cities have long been responsible for creating and maintaining environments that are conducive to business prosperity. Climate change has added a new dimension to this responsibility, which, to be managed effectively, requires cooperation across the public and private sectors. The case studies in this report demonstrate that collaborative action by cities and business is critical. Cities can directly improve the resilience of their core capital – through public services and infrastructure investments – and empower and mandate businesses to do the same. Businesses, in turn, can embed adaptation needs in their own operations and global supply chains, improving resilience to climate change. The combined effect of these actions creates urban environments that can thrive despite the negative effects of rising global temperatures.

Climate change has added a new responsibility to the dimension between cities and business.

More action is needed, however, to ensure cities and businesses recognize all the key local risks. Once cities assess climate change risks, they are extremely likely to take action. While cities and business must work more closely to align their understanding and response to climate change risks, it is significant that cities are recognizing – and acting upon – the most severe risks identified by businesses. This mutual recognition of climate change risks is an important step to taking action that creates safe, resilient cities that are also attractive places to do business, invest and innovate.



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City of Cape Town*
City of Dar es Salaam*
City of Durban
City of Johannesburg*
City of Lagos*
City of Nairobi*
City of Pietermaritzburg
Pretoria – Tshwane

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Changwon City*
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Gapyeong County
Geoje City
Geumsan County
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Gurye County
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Gwangyang Metropolitan Government
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*Denotes C40 City



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CDP contacts

Paul Dickinson
Executive Chairman

Paul Simpson
Chief Executive Officer

Nigel Topping
Chief Innovation Officer

Conor Riffle
Director, Cities and
Data Product Innovation

Authors

Larissa Bulla
Head of Cities

Katie Walsh
Account Manager,
North America

Andreia Banhe
Account Manager,
Latin America

Pauline Martin
Account Manager

Sara Telahoun
Project Officer

CDP Board of Trustees

Chair: Alan Brown
Schroders

Ben Goldsmith
WHEB Group

Chris Page
Rockefeller
Philanthropy Advisors

James Cameron
Climate Change Capital

Jeremy Smith
Berkeley Energy

Takejiro Sueyoshi

Tessa Tennant
The Ice Organisation

Martin Wise
Relationship Capital Partners

AECOM team

Gary Lawrence
Chief Sustainability Officer

Claire Bonham-Carter
Principal, Director of
Sustainable Development

Alexander Quinn
Director of Sustainable Economics

Vanessa Lauf
Economist

Daniel Elsea
Creative Director

Sarah Nadin
Graphic Designer

Contact

Claire Bonham-Carter
AECOM
+1 415 955 2800
claire.bonham-carter@aecom.com
www.aecom.com/News/Sustainability

C40 team

Seth Schultz
Head of Research,
Measurement and Planning

Kerem Yilmaz
Head of Research

Michael Doust
Head of Measurement and Planning

Mike Marinello
Director of Communications

Brooke Russell
Head of Editorial and Content

Kathryn Vines
Network Manager, Climate Change
Risk Assessment

Ava Zekri
Manager, City Reporting

CDP

40 Bowling Green Lane
London EC1R 0NE
United Kingdom
Tel: +44 (0) 20 7970 5660
Fax: +44 (0) 20 7691 7316
www.cdp.net
cities@cdp.net
@CDP

Lead Sponsor

AECOM