

OECD Environment Working Papers No. 14

Cities, Climate Change and Multilevel Governance

Jan Corfee-Morlot,
Lamia Kamal-Chaoui,
Michael G. Donovan,
Ian Cochran,
Alexis Robert,
Pierre-Jonathan Teasdale

https://dx.doi.org/10.1787/220062444715

OECD

Unclassified **ENV/WKP(2009)9**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **13-Jan-2010**

English - Or. English

ENVIRONMENT DIRECTORATE

ENV/WKP(2009)9
Unclassified

Cancels & replaces the same document of 02 December 2009

ENVIRONMENT WORKING PAPER No. 14

Cities, Climate Change and Multilevel Governance

By
J. Corfee-Morlot, L. Kamal-Chaoui, M.G. Donovan, I. Cochran, A. Robert and P.J.Teasdale

JEL classification: Q51, Q54, Q56, Q58, R00.
Keywords : Climate; Global Warming; Sustainable Development; Government Policy; Regional, Urban and Rural Analyses; Regional Economics

All Environment Working Papers are available at www.oecd.org/env/workingpapers

JT03276956

Document complet disponible sur OLIS dans son format d'origine
Complete document available on OLIS in its original format

English - Or. English

OECD ENVIRONMENT WORKING PAPERS

This series is designed to make available to a wider readership selected studies on environmental issues prepared for use within the OECD. Authorship is usually collective, but principal authors are named.

The papers are generally available only in their original language English or French with a summary in the other if available.

The opinions expressed in these papers are the sole responsibility of the author(s) and do not necessarily reflect those of the OECD or the governments of its member countries.

Comment on the series is welcome, and should be sent to either env.contact@oecd.org or the
Environment Directorate, 2, rue André Pascal, 75775 PARIS CEDEX 16, France.

OECD Environment Working Papers are published on
www.oecd.org/env/workingpapers

Applications for permission to reproduce or translate all or part of this material should be made to: OECD Publishing, rights@oecd.org or by fax 33 1 45 24 99 30.

Copyright OECD 2009

ABSTRACT

Cities represent a challenge and an opportunity for climate change policy. As the hubs of economic activity, cities generate the bulk of GHG emissions and are thus important to mitigation strategies. Urban planning will shape future trends and the concentration of population, socio-economic activity, poverty and infrastructure in urban areas translates into particular vulnerability to increased climate hazards. City governments and urban stakeholders will therefore be essential in the design and delivery of cost-effective adaptation policies. Further, by empowering local governments, national policies could leverage existing local experiments, accelerate policy responses, foster resource mobilization and engage local stakeholders.

This paper presents a framework for multilevel governance, showing that advancing governance of climate change across all levels of government and relevant stakeholders is crucial to avoid policy gaps between local action plans and national policy frameworks (vertical integration) and to encourage cross-scale learning between relevant departments or institutions in local and regional governments (horizontal dimension). Vertical and horizontal integration allows two-way benefits: locally-led or bottom-up where local initiatives influence national action and nationally-led or top-down where enabling frameworks empower local players. The most promising frameworks combine the two into hybrid models of policy dialogue where the lessons learnt are used to modify and fine-tune enabling frameworks and disseminated horizontally, achieving more efficient local implementation of climate strategies.

Such integration generates benefits at all stages of the policy process. This includes agenda setting and strategic planning, to encourage political leadership and stakeholders' support; policy formulation and approval to promote long-term vision and near term action; local implementation to overcome obstacles, build necessary capacity, and establish reliable financing for action; feedback and evaluation; and dissemination to promote information sharing and cross-scale learning.

A review of current practices suggests the need for national governments to help create a sound institutional foundation and knowledge base to support decision making and action at local levels. This includes developing harmonized GHG inventory methods for local government use, boundary organisations to generate regional science-policy or economic-policy information, and developing strong urban climate policy networks. Making such tools available will help local governments to design, implement and refine policies to find cost-effective climate policy solutions and drive economic development in green sectors. It will also help national governments to deliver on ambitious climate policy goals in the coming decades.

JEL classification: Q51, Q54, Q56, Q58, R00.
Keywords : Climate; Global Warming; Sustainable Development; Government Policy;
Regional, Urban and Rural Analyses; Regional Economics

RESUME

Les villes représentent un défi et une opportunité pour les politiques du changement climatique. Centres d'activité économique, elles génèrent la majeure partie des émissions de GES et sont donc centrales pour les stratégies de mitigation. Les décisions d'urbanisme détermineront les futures émissions et les agglomérations urbaines sont particulièrement exposées à l'accroissement des risques climatiques, car elles concentrent population, activité socio-économique, pauvreté et infrastructures. Les gouvernements locaux et les partenaires urbains seront donc essentiels pour la conception et le déroulement de politiques d'adaptation au meilleur coût. De plus, en impliquant activement les gouvernements locaux, les politiques nationales pourraient mettre à profit les expériences locales, rendre les réponses de politiques publiques plus réactives, encourager la mobilisation des ressources et mettre en prise les parties prenantes locales.

Ce document présente un cadre pour la gouvernance multi-niveau et montre qu'il est essentiel de développer la gouvernance en matière de changement climatique, à tous les niveaux de gouvernement ainsi qu'auprès des partenaires concernés, afin d'une part d'éviter des vides de compétence entre les plans d'action locaux et les politiques-cadres à l'échelon national (intégration verticale), et afin d'autre part d'encourager des échanges croisés entre les services concernés des différents échelons de compétence, régionaux et nationaux (intégration horizontale). L'intégration, verticale et horizontale, est bénéfique dans les deux sens : ascendant, lorsque les initiatives locales influencent l'action au plan national ; et descendant lorsque les cadres nationaux permettent des délégations de compétence aux acteurs locaux. Les cadres de gouvernance les plus prometteurs combinent les deux sens en un modèle « hybride » qui favorise le dialogue de politique publique, et où les leçons apprises sur le terrain peuvent à la fois remonter pour modifier et améliorer les cadres nationaux, et se diffuser horizontalement. Ce schéma permet une mise en œuvre plus efficace localement des stratégies climatiques.

Une telle intégration est bénéfique à tous les stades du processus politique. En particulier : pour décider des objectifs et planifier les stratégies, encourager le leadership politique et le soutien des parties prenantes ; pour formuler les politiques et forger l'adhésion autour d'une vision de long terme et des actions immédiates à mener ; pour mener les actions locales qui pourront surmonter les obstacles, développer les capacités nécessaires et assurer des sources fiables de financement ; pour examiner et évaluer les expériences ; pour diffuser et promouvoir le partage d'informations et d'expériences entre les différents échelons.

Une revue des pratiques actuelles révèle le besoin pour les gouvernements nationaux d'aider à la création d'un support institutionnel solide et d'un socle de connaissances qui soutienne les prises de décisions et d'actions à l'échelon local. Ce qui comprend : l'élaboration de méthodes harmonisées, à l'usage des gouvernements locaux, pour inventorier les émissions de GES ; la création d'interfaces pour faciliter les échanges entre les sphères scientifique et politique, ainsi que politique et économique ; et mettre en place de solides réseaux de politique climatique urbaine. Mettre ces outils à la disposition des gouvernements locaux leur permettra de concevoir, mettre en œuvre et perfectionner leurs politiques climatiques en les rendant plus efficaces, moins onéreuses et plus porteuses de développement économique dans les secteurs verts. Cela aidera également les gouvernements nationaux à formuler des objectifs de politique climatique plus ambitieux au cours des prochaines décennies.

Classification JEL : Q51, Q54, Q56, Q58, R00.

Mots-clés : Climat ; Réchauffement climatique ; Développement durable ; Politique publique ; Analyses spatiales, urbaines et rurales ; Économie géographique

FOREWORD

This report is the result of a joint project overseen by two Working Parties of the OECD: the Working Party on Territorial Policy in Urban Areas under the Territorial Development Policy Committee, and the Working Party on Global and Structural Policies under the Environment Policy Committee. It was prepared by Jan Corfee-Morlot (OECD Environment Directorate), Lamia Kamal-Chaoui, Michael G. Donovan and Alexis Robert (OECD Public Governance and Territorial Development Directorate), as well as Ian Cochran, Pierre-Jonathan Teasdale (in-house consultants to the OECD).

We would also like to acknowledge assistance from Michaël Bégorre Bret in the final editing of the document and contributions from a number of authors who have contributed relevant background materials on which we have drawn liberally. Notably Adam Ostry, Chairman of the OECD Working Party on Urban Areas and Director General, Infrastructure Canada; Dale Medearis, Senior Environmental Planner, Northern Virginia Regional Commission (NVRC); Miranda Schreurs, Director of the Environmental Policy Research Centre and Professor of Comparative Politics at the Freie Universität Berlin; Stéphane Hallegatte, Centre International de Recherche sur l'Environnement et le Développement, Paris, France; and Kara Reeve, M.I.T. Department of Urban Studies and Planning.

Finally the authors are those who commented on the report, including: Helen Mountford, Marcos Bonturi, Claire Charbit, Aziza Akhmouch, Shardul Agrawala and Arnoldo Matus-Kramer of the OECD; Sara Pasquier and Ralph Sims of the IEA; Mila Freire of the World Bank; Meinte de Hoogh of the Dutch government; Rene-Laurent Ballaguy and Pierre-François Clerc of the French Government; Juan Carlos Zentella Gomez of the Mexican government; the Portuguese government; and Hélène de Largentaye, City of Paris.

This paper is released as part of the Environment Working Paper Series N° 14 [ENV/WKP(2009)9]. It can be downloaded on OECD websites, see:

www.oecd.org/env/cc/cities and www.oecd.org/gov/cities

Further enquiries about this work in this area should be addressed to:

- Jan Corfee-Morlot (jan.corfee-morlot@oecd.org), of the OECD Environment Directorate; and
- Lamia Kamal-Chaoui (lamia.kamal-chaoui@oecd.org), of the OECD Public Governance and Territorial Development Directorate.

TABLE OF CONTENTS

ABSTRACT 3

FOREWORD 5

EXECUTIVE SUMMARY 9

1. INTRODUCTION 14

Key trends: why cities matter to climate policy 15
Urbanisation, economic growth and energy use 15
Changing climate at the global level and the impact on cities 18
Urban specific climate impacts - hot spots 20
Interface between urban socio-economic development and climate impacts 21
Co-benefits of climate policies at local level 22
Aim and approach 24

2. MULTILEVEL GOVERNANCE: A CONCEPTUAL FRAMEWORK 26

Methodology and key questions to structure the analysis 29

3. LOCAL AND REGIONAL GOVERNANCE 31

Increasing role of local and regional governments in climate change policies 31
The public policy process: The planning behind climate change action plans and policies 32
(1) Agenda setting 33
(2) Policy formulation 35
(3) Implementation 38
(4) Policy evaluation 42
Collaboration between municipalities and regional government 43
Inter-municipal action to combat climate change 43
Regional strategies and actions 44
Summary points 45

4. LOCAL-NATIONAL CLIMATE POLICY LINKAGES 47

Main rationale for local-national policy linkages 47
Institutional models: local-national cooperation on climate change 51
Nationally led -- “top-down” enabling frameworks 51
Learning from the “bottom up” -- from cities and regions to national action 53
Hybrid models 55
Incorporating climate change into existing national, regional and urban development frameworks 59
Addressing national barriers to local action 61
Summary points 63

5. BUILDING INSTITUTIONS TO ENHANCE LOCAL KNOWLEDGE AND STRENGTHEN ACTION 65

Analytic-deliberative capacity and policy networks formation 65
Developing the toolbox to harness city-scale decision making 67
Monitoring progress: cities, mitigation and GHG inventories 67
Assessing regional and local impacts through sub-national science-policy exchange 74
Urban policy network and climate change 79
The role of non-public actors in climate change 79
Role of non-governmental actors in the local policy process stage framework 79
Trans-border regional cooperation and international networks of cities 82
Summary points 84

6. CONCLUSIONS 86

Policy implications of multilevel climate change governance 86
Towards a new climate change governance paradigm 88
Recommendations and possible future work 89

ANNEX A: EXAMPLES OF MULTI-LEVEL GOVERNANCE LINKING IN CLIMATE POLICY 90

Multilevel governance in China: voluntary agreements 90
Multilevel governance in Japan 91
Multilevel governance in Finland 92
Multilevel governance in New Zealand 93
Multilevel governance in Portugal 94
Multilevel governance in Sweden: KLIMP – Sweden's Climate Investment Program 95
Oregon and Portland Green Building Multilevel Governance 96
Sao Paulo and CDM 97
Cape Town – South Africa 98
New York City 99
Catalonia/Barcelona 100

ANNEX B: INFORMATION ON REGIONAL IMPACT SCIENCE-POLICY INSTITUTIONS 102

IRI 102
Ouranos 102
PIER programme 102
UKCIP 103
Club ViTeCC – Villes, Territoires et Changement Climatique 103

BIBLIOGRAPHY 105

Tables

Table 1. Types of impacts with a few examples of impacts in cities. 19
Table 2. Related aims and co-benefits of sector policies to reduce GHGs at urban scale 24
Table 3. Local-Level Mitigation and Adaptation Policies Across Sectors 32
Table 4. Modes of governing and local climate change policy (Mitigation) 40
Table 5. Climate change and multilevel governance: key actors, functions and tools at different scales of action 49
Table 6. Frameworks and Institutional Models of Multilevel Governance on Climate Change 57
Table 7. Examples of antagonistic interplays among adaptive sectoral policies with respect to adaptive responses: a bottom-up perspective 62
Table 8. Selected city-scale GHG inventory reports: comparison of key features 73
Table 9. Institutional models for climate change information development and exchange 77
Table 10. National versus local strengths putting principles of good governance into practice 88
Table 11. Overview of Swedish National-Local Climate Programme 96

Figures

Figure 1. World population trends – urban – rural breakdown 16
Figure 2. Difference in GDP per capita, labour productivity and employment between OECD metro-regions and their national average (2005) 17
Figure 3. Maps showing the Top 20 port cities' exposed assets (a) and exposed population (b) in a future scenario with socio-economic development, subsidence and climate change (FAC scenario). Takara Teranishi 23
Figure 4. Stages in the public policy process 33
Figure 5. Related aims and co-benefits of sector policies to reduce GHGs at urban scale 54
Figure 6 U.S. National CO2 Emissions, by End-Use Sector 71

Boxes

Box 1. Climate change, urban heat island effect, air pollution and health 21
Box 2. Decision Criteria Used by Seattle's Green Ribbon Commission 36
Box 3. Darebin City Council's Criterion List for Prioritising Greenhouse Gas Reduction Actions 37
Box 4. Cases of Metropolitan Coordination for Climate Change Action Planning 44
Box 5. Transportation 2035 Plan for the San Francisco Bay Area 45
Box 6. Regional Policy and Climate Change: examples from a selection of OECD countries 60
Box 7. Transnational Networks of Cities Addressing Climate Change 83

EXECUTIVE SUMMARY

How cities develop matters to the delivery of a low-carbon, climate resilient future, and it will also determine the feasibility of sustainable economic development across the OECD and worldwide. As energy demand and carbon emissions concentrate in population centres, urban areas present important opportunities for reducing human impact on the global climate. Metropolitan regions are also particularly vulnerable to climate change, given their relatively large populations, exposed infrastructure, high degree of economic activity, and concentration of poor populations. Climate change poses a unique policy challenge to metropolitan regions and presents an opportunity for national governments aiming to achieve ambitious climate policy goals.

Metropolitan areas provide the engines of the global economy, and are often responsible for the bulk of national output, innovation and employment. Due to the concentration of population and economic activities, urban areas are also responsible for the consumption of the majority of the world's energy and other resources, and thus are perhaps the single largest "source" of global greenhouse gas emissions. Urbanisation can reinforce sprawling spatial patterns, generating greater capital costs and environmental stress, including rising greenhouse gas emissions. Urban planning decisions about how cities grow lock society into development patterns that persist for decades to come. Especially in countries undergoing rapid urbanisation, a shift to climate-friendly urban development patterns offers enormous opportunity for cost-effective action.

Urban centres may also be particularly vulnerable to the impacts of climate change. Cities are disproportionately located in coastal areas, putting them at risk from rising sea levels. Extreme storm and heat impacts, partly due to urban heat island effects, can damage the physical and social infrastructure on which cities' rely to maintain their productivity and competitiveness. Low-income populations often concentrated in inner-city areas, in both industrialised and developing nations are expected to be the most vulnerable to climate change in part due to the lack of resources and capacity to respond in a timely manner.

How cities develop is part of the climate problem, but it can also be part of the solution. The right choice of urban policies may ensure that long-lasting infrastructure is designed to withstand the expected increase in climate hazards and improve the energy and emission performance of the built environment. Limiting the exposure and vulnerability of urban dwellers and infrastructure to the growing threat of climate change requires integrated urban planning. Action is needed to address simultaneously both adaptation to potential climate change effects and mitigation of cities' impact on climate.

City and regional governments are increasingly initiating action on climate change. However, to date these initiatives have been largely decoupled from national policy frameworks. This has limited the resources available to cities to support experimentation with innovative urban practices and the ability to identify and more broadly diffuse good urban and territorial development policy practices to address climate change.

This paper applies a multilevel governance framework to explore linkages between national, regional and local policies and to explore the strengthening of multilevel, regional and urban governance to more effectively address the problem of climate change. A multilevel governance framework calls for the

narrowing or closing of the policy "gaps" between levels of government via the adoption of tools for vertical and horizontal cooperation. The vertical dimension of multilevel governance recognises that national governments cannot effectively implement national climate strategies without working closely with regional and local governments as agents of change. A multilevel governance approach also recognises that local governmental authority to act in areas related to climate change is often "nested" in legal and institutional frameworks at higher scales. A two-way relationship exists between local and national action on climate change as each can enable or constrain the other.

The horizontal dimension of multilevel governance acknowledges the opportunity for learning, information transmission and cooperation between cities or regions and national governments, including local jurisdictions in the same metropolitan area. Horizontal governance activities can give business, research and environmental non-governmental organisations influence in the policy dialogue process. The horizontal dimension of multilevel governance is also associated with improving coordination across national line ministries to implement cross-cutting programmes, such as those required in many climate change policies. Horizontal relationships at the sub-national level can also exist in the form of national and transnational networks and coalitions.

With a particular emphasis on the role of sub-national regions and cities, this paper considers the question of "what is good practice"? It takes an inter-disciplinary approach and draws upon a range of examples from metropolitan regions and national-local policies across the OECD and beyond. Within the multilevel governance framework, the paper evaluates a number of principles of "good practice" and their application in urban, regional and national climate policies to date. These principles or dimensions of good practice include: ensuring participatory governance; provision of a strong analytical foundation for short and long-term planning; delivering cost-effectiveness and economic efficiency; encouraging experimentation and innovation; addressing of distributional consequences and procedural equity; establishing a long-term planning horizon; delivering policy coherence; and building monitoring, reporting and evaluation into policy practice.

The paper examines experience to date and examples across levels of policymaking as they pertain to these principles of "good practice". The following questions structure this analysis:

- How is climate policy playing out across local levels or horizontal levels of governance? How well are such policies working and why? (Section 1)

- What different forms of national-local policy linkages exist to implement mitigation and adaptation policies? How well are such policies working and why? (Section 2)

- What are the key tools for good multilevel governance of climate change and what can be done to better put these in place? (Section 3)

Regarding local and regional governance, the paper documents a growing number of cities and regions that have taken initiatives to reduce their energy use and greenhouse gas emissions and to adapt to climate change. In recent years, urban political leaders have become more involved in climate change policymaking. This engagement is reviewed at each of five distinct stages in the policy process: agenda setting, policy formulation and approval, implementation, feedback evaluation, and dissemination of ideas and replication elsewhere.

> **Agenda setting or strategic planning** can be driven by political leadership or support from the business sector or general public. Local governments and regions may respond to climate change because of concerns about the long-term effects of inaction or the potential to create "green" jobs.

Obstacles include overlapping mandates, lack of decision-making authority in key policy areas, and low prioritisation of motivation for adaptation policies.

Policy formulation and approval typically involves coordination among stakeholders and policy leaders to discuss policy priorities, implementation strategies and monitoring mechanisms. Municipalities and provinces respond in a variety of ways: i) self-governing, *e.g.* purchasing policies that prioritize energy efficiency or "greening" of municipal buildings; ii) providing public services; iii) enabling citizens and business activities to take actions; and iv) regulating market actors and behaviour. A main obstacle to effective policy formulation is the tendency to favour policies that are feasible in the short term, regardless of whether they fit within an integrated urban planning framework and longer term climate change policy goals.

Implementation of climate change policies and action plans varies by mode of urban governance and national context. Inevitably, local implementation of climate change actions faces a number of implementation obstacles, including: institutional blockage within local governments; insufficient capacity and expertise; funding barriers; lack of devolved authority; and inadequate support from central governments and/or lack of alignment of policies. The absence of appropriate national policy and regulatory climate frameworks undermines local or regional climate plan implementation.

Feedback and evaluation are also essential but have rarely been used to measure the outcomes of local climate policies. The lack of standardised tools to develop performance benchmarks or create a monitoring system to assess policy performance hinders policy evaluation and performance over time.

Dissemination of policy experiences and best practices from a municipality or region may occur through information sharing in regional or transnational/transboundary networks of municipalities. Dissemination may also be triggered through national or regional policy channels where successful policies are taken up more broadly.

Regional,[1] as opposed to municipal, approaches to climate change mitigation and adaptation can, due to their scale, accomplish structural changes that would not be possible at the city level. Greater technical and financial capacity and environmental know-how may exist at the regional level than in individual municipalities. Regions can also develop strategies to link policies and programmes that would otherwise operate in isolation, *e.g.* connecting initiatives between urban and rural areas or across multiple adjacent municipal authorities. By allowing municipalities in the same metropolitan region to coordinate on land-use planning and public services provision, regional collaboration can achieve mitigation and adaptation targets more efficiently than if municipalities were to act individually.

With respect to local-national climate policy linkages, a review of experience reveals at least three types of institutional models that influence or guide policy action on climate change across levels of government:

Nationally led or top-down enabling frameworks with predominant influence moving from national to local action. This uses national policy to steer local or regional authorities to take climate change into account at the local level. Frameworks can include national mandates that leave wide latitude for local authorities to shape policies on climate change to fit local contexts.

[1] The term "regional" in this document refers to other sub-national – larger than municipal or urban but smaller than national (e.g. regions, provinces, counties, etc).

Locally led or bottom-up action that influences national action. In this model, learning and experience acquired through autonomously initiated successful local programmes inform and steer policymaking at higher levels of government.

Hybrid models showing features of both. In this approach, national governments may provide enabling frameworks but give local governments a certain amount of discretion to tailor local initiatives. Also the private sector may be a central actor, *e.g.* through international or national carbon markets. Successful examples may be replicated through initiatives led at higher levels of government.

How regional policy at the national level interfaces with national climate change strategies is emphasised in this paper. On the one hand, a "green" lens may be used to shape regional development policies; on the other hand, national climate change strategies may be implemented using a regional-policy filter. This highlights the challenge of intra-governmental coordination and coherence in developing and implementing cross-sectoral approaches to advance regional development objectives using a climate change or, more broadly, sustainability lens. Pre-existing policies may incite "mal-adaptation" or "mal-mitigation" and thus counteract progress made in more targeted climate policies. To ensure successful regional and local implementation of national climate policy goals throughout a country, systematic efforts are needed to align incentives across sectoral and cross-sectoral policy areas.

Finally the paper investigates three tools that may be used to advance good practice in multilevel governance and to enhance the capacity of local governments to be more effective on climate change issues:

A **harmonised city-scale GHG inventory and coherent accounting methodologies** can enhance monitoring and data collection to allow more systematic assessment of mitigation performance, options and comparison across cities. Cities require solid technical input and national and international support to connect their inventory approaches or protocols to existing IPCC guidance and UNFCCC national reporting systems. It will be difficult, if not impossible, to integrate urban-scale mitigation action into emerging national regulatory frameworks and carbon markets without these critical links to the internationally established methods that support measurement, review and verification under the Climate Change Convention.

Establishing **science-policy capacity and other policy relevant research** to support timely and cost-effective adaptation and mitigation decisions at local scale is essential for regional capacity to assess, design and implement policies. Funding for such work will inevitably need to come from national governments, or relevant sub-national authorities, as it provides a public good that can be useful to stimulate climate action across urban regions in an entire nation or region.

Encouraging better development of **urban climate policy networks**, in particular through the engagement of regional and local non-governmental stakeholders at various stages of the policy process, could deepen local scientific knowledge and integrate local perspectives in the drafting and implementation of coordinated and integrated mitigation and adaptation strategies.

In conclusion, some general observations of "good" multilevel climate change governance emerge from this review:

- ***First, national policies can powerfully enable local action on climate change adaptation and mitigation.*** To avoid a patchwork of uncoordinated targets, goals, and programmes, national governments can and should take the lead on the design and implementation of broad cross-cutting instruments. National policies may also advertently or inadvertently constrain the ability

of local authorities to act, leading to "mal-adaptation" or "mal-mitigation". In some cases, a problem may arise because authority is not devolved to local governments on key issues, such as transportation planning. Where authority is decentralised there is a need to ensure the availability of financial resources to design and implement local climate policies. More generally there is a need to ensure that national policies appropriately incite action at regional and local levels and climate change considerations are fully integrated into decision making criteria established both centrally and locally.

- ***Second, there is significantly greater potential for experimentation at local scales, which in turn can be a testing ground for national governments.*** Where successful, such experiments can provide an essential evidence base with new forms of policy and open the possibilities for broader diffusion in other urban areas or possibly nationally. A key aim of national policy may be to encourage, enable and possibly finance experimentation that goes above and beyond nation-wide action. In this way, urban policy can be a laboratory for larger-scale efforts.

- ***Third, close collaboration between local and national authorities to build capacity on the climate change issue will improve the chances that local authorities will exploit potential for cost-effective mitigation and adaptation to climate change.*** Indeed some of this potential is available through local action, for example, by integrating understanding about climate change risks into local land use and zoning practices, coastal zone or disaster management. Responses to some problems posed by climate change, such as managing water stress or flood risk, are in the hands of city managers. On other priorities essential to the mitigation policy agenda, such as reducing emissions from transport, urban and regional planners are also key players. With proper resources to anticipate and address these issues, city authorities can be a proactive force for action on climate change.

- ***Fourth, some effective cross-sectoral regional or urban development strategies appear to be driven by the climate change imperative, where climate change mitigation and adaptation is seen to be a potential source of regional economic development***. By contrast, strategies based on adding a "green" component in a more isolated manner to sectoral regional development policy drivers (for example, infrastructure development), seem less likely to successfully sustain regional economic development and tackle climate change over the longer term. This assumes that national and local governments identify and exploit synergies, and work to address trade-offs economic development where they exist.

Some principles for good practice are more easily advanced at lower rather than higher levels of governance, or at least require the engagement of local authorities to ensure delivery and effectiveness. For example, the engagement of local governments may democratise and increase citizen engagement in climate change activities. City authorities are in a unique position to engage local stakeholders and design locally tailored responses to climate change. They may also be better situated than national governments to confront many of the difficult challenges related to adaptation, including managing flood risk, water stress, or the "climate proofing" of urban infrastructure. With respect to mitigation, local authorities may be better placed than national governments to reduce GHG emissions from some key sources such as waste and transport, and deliver a range of co-benefits to local citizens. They can be supported by specific central government policies for experimenting with innovative solutions that could, if they provide good results, be implemented in other places. Urban and territorial development policies may also offer particular opportunities to address climate change. Strengthening multilevel governance approaches is therefore key to delivering both low-carbon and climate-resilient development in the future.

1. INTRODUCTION

The climate policy challenge for cities can be simply stated as a two-way struggle to achieve climate change protection and development simultaneously. One will affect the other – they are inseparable. In other words:

The fate of the Earth's climate and the vulnerability of human society to climate change are intrinsically linked to the way the cities develop over the coming decades and century[2]

Action on climate change must also be along two broad fronts to include both adaptation and mitigation simultaneously.[3] The earlier and more cost-effective our action to mitigate greenhouse gases (GHG), the more we can do to protect the climate and limit the risk of dangerous climate change over the medium and long-term. Equally, the earlier we adapt, the more we can cost-effectively protect people and infrastructure from dangerous impacts of inevitable climate change (IPCC, 2007a; Stern, 2007; OECD 2008; Nicholls *et al.* 2008).

Climate change poses a difficult, inter-generational challenge, since the policy and investment decisions being made today will shape the climate for future generations. Choices about the way we produce and use energy, about transportation modes, about land use, about what and how much we consume will all influence GHG emissions and vulnerability to climate change in the coming decades. As a result, any political decision to deal with climate change inevitably involves balance and the tension amongst a range of choices: the balance of effort to adapt "now versus later" to a range of uncertain climate changes and tension between different types of effort, such as to "mitigate and/or adapt" in any particular regional setting (Corfee-Morlot, 2009).

Climate change is increasingly being observed, and projections on a regional scale have become possible and increasingly reliable and robust (even if still highly uncertain over long time frames). Both developments have increased the ability to make decisions about adaptation and mitigation today, particularly at the sub-national or local scales (Cash and Moser, 2000). Urban planning decisions about how cities grow lock society into development patterns that persist for decades to come. Where climate change is concerned, the broad uncertainties around key climate change outcomes, combined with uncertainty about socio-economic urban trends, place an emphasis on the need for prudent risk management strategies to be integrated into decision making starting today.

How cities develop is part of the climate problem, but it can also be part of the solution. The right choice of urban policies is particularly important to ensure that long-lived infrastructure – commercial and residential buildings, roads and ports, water and transport networks – are designed to withstand the

[2] Adapted from Tyndall Centre. 2004. A briefing on climate change and cities: Briefing Sheet 30, British Council. This statement is reworked from the Tyndall Centre report which argued"*...the fate of the Earth's climate is intrinsically linked to how our cities develop over the coming decades*".

[3] The IPCC (2007c) defines adaptation as "Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects." Mitigation is defined as "Technological change and substitution that reduce resource inputs and emissions per unit of output…. with respect to climate change, mitigation means implementing policies to reduce GHG emissions and enhance sinks."

expected increase in climate hazards while simultaneously improving the energy and emission performance of the built environment (Hallegatte *et al.* 2008; Saitherwaite 2008; McEvoy 2006). Integrated urban planning is central to land use decisions and zoning that may exacerbate or limit the exposure and vulnerability of urban dwellers and infrastructure to the growing threat of climate change. Similar issues pertain to mitigation, for example, in transportation and land-use planning, which are key to improving accessibility while at the same time to reducing the demand for mobility and emissions (Hallegatte *et al.* 2008).

There is a special need to focus on cities because, how cities develop will determine our ability to deliver a low-carbon, climate resilient future and thus the pursuit of sustainable economic development across the OECD and worldwide. City authorities may be in a unique position to usefully engage local stakeholders and to design and implement locally tailored responses to climate change. This, combined with the pressing need to engage all of government in efforts to mitigate and adapt to climate change, underscores the need for attention to multilevel governance, i.e. governance across all levels of government and active engagement with stakeholders within a particular level. A key question is how can multilevel governance be used to accelerate and mobilise resources to address climate change?

Despite increasing levels of attention and action on climate change at city scales, much of this activity is largely decoupled from national policy frameworks. Moreover, relatively little policy analysis or research has considered the issue of the multilevel governance of climate change and the unique role of cities within such a framework.[4] Yet multilevel governance is a critical issue for national governments, the large majority of which have agreed to work together to limit dangerous climate change through mitigation action to reduce GHG emissions and to adapt to inevitable climate change. A key issue for national policymakers is what they can do to empower cities to become effective in the design and implementation of policies for mitigation and adaptation to climate change and to take advantage of the opportunities to learn from city-scale experimentation and action with a range of different local climate response policies.

Given this a central question for national policy makers becomes: What role can and should cities authorities play in the design and delivery of cost-effective and timely climate policies? And how can central governments assist and encourage them to fulfil their potential to become effective players?

Key trends: why cities matter to climate policy

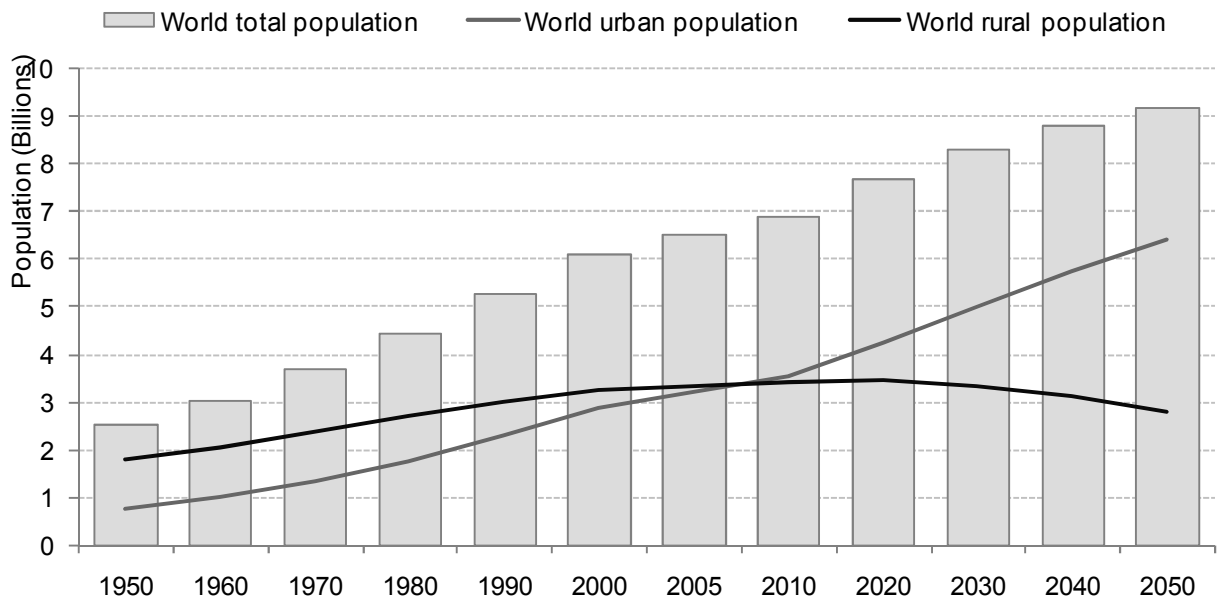
Urbanisation, economic growth and energy use

Urbanisation is a worldwide phenomenon and is expected to continue for decades to come (OECD, 2006; OECD, 2008; United Nations, 2008). According to the United Nations, roughly half of the world's population lives in urban areas, and this share is increasing over time, projected to reach 60% by 2030; Figure 1). Within the OECD, urbanisation is already well advanced with more than 53% of the total population living in urban areas; this number rises to almost 83% if we include intermediate, less densely populated areas characterised by systems of medium-sized cities. However, although urbanisation growth within the OECD is still ongoing (Figure 2), most of the urban population growth up to 2030 will occur in developing countries. Developing countries are projected to have urban growth rates roughly double those of OECD countries in the 2005-2030 timeframe (United Nations, 2008) China, for instance, which is

[4] For example, the IPCC Fourth Assessment Report acknowledges the role of cities in design and delivery of climate responses, however it remains marginal to the full volume which is largely focused on the global dimensions of the problem and its possible solutions. For chapters that address local dimensions of climate change and policy responses see: Wilbanks and Romero *et al.* 2007; Gupta and Tirpak *et al.* 2007; Sathaye and Adjam *et al.* 2007. Bulkeley and Betsill (2005) and Betsill and Bulkeley (2007) are notable exceptions in bringing attention to multi-level governance. The UNFCCC (2006) in their review of progress in national policy under the Kyoto Protocol also briefly highlights some trends for national governments to work more closely with local governments.

already the largest urban nation in the world, will see its current urban population rising from 600 to 900 million by 2030. As of 2015, the newly added urban population will be larger than the total population of many OECD countries such as Germany, Japan, Mexico, France (Kamal-Chaoui *et al.*, 2009). Though the pace of urban growth will be highest in smaller towns and cities in countries in Africa and Asia, the proportion of the world's population living in so-called megacities, or urban centres with more than 10 million people, is also predicted to rise to 12% in 2025, from about 9% today, and the number of megacities will rise from 19 to 27 (United Nations, 2008).

Figure 1. World population trends – urban – rural breakdown

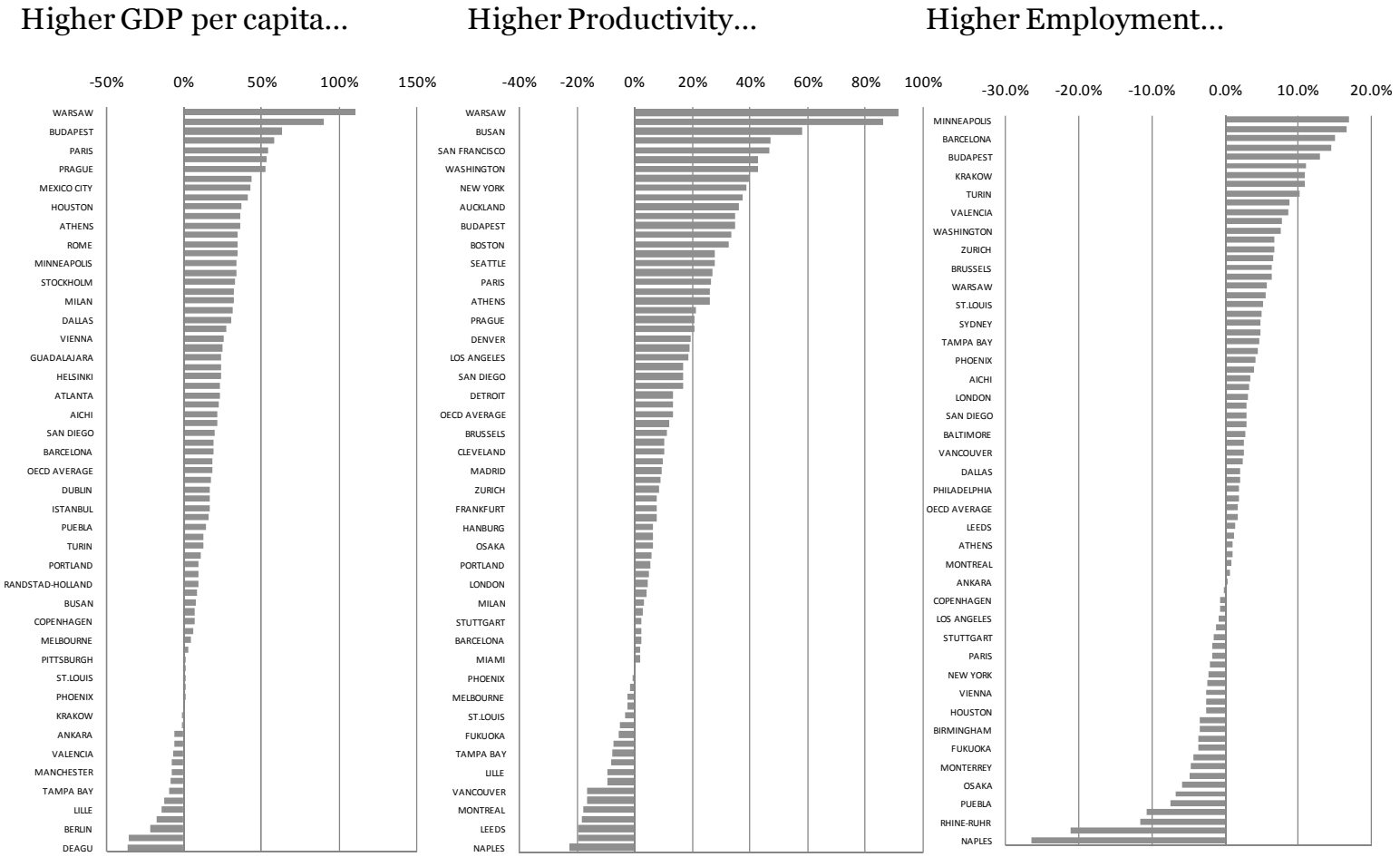


Source: United Nations (2007) World Population Prospects: The 2008 Revision Population Database, http://esa.un.org/unpp/.

Trends in urbanisation and population concentration are closely linked with concentration of economic activities and production (OECD, 2009). As key engines of the global economy, metropolitan areas,[5] are responsible for the bulk of national output, innovation and employment (OECD, 2006). In many OECD countries, for instance, one single metro-region produces one-third (*e.g.* Oslo, Auckland, Prague, Tokyo, Stockholm, London, Paris), to one-half of the national GDP (Budapest, Seoul, Copenhagen, Dublin, Helsinki, Brussels, and Montreal, Toronto, Vancouver in their respective provinces) (OECD 2008). Thanks to the benefits of agglomeration economies, most OECD metropolitan regions with 1.5 and more inhabitants feature a higher GDP per capita, a higher labour productivity and higher employment level than their national average (Figure 2). However, the benefits associated with economies of agglomeration are not unlimited; cities can reach a point where they no longer provide increasing returns and become less competitive (OECD, 2009). One of the main explanations of such mixed outcomes is linked with the existence of negative externalities, including congestion and other environmental costs such as high carbon-intensities and/or high vulnerability to climate change and natural disasters.

[5] Metropolitan areas are typically defined as concentrations of population and economic activity that constitute functional economic areas covering a large number of authorities.

Figure 2. Difference in GDP per capita, labour productivity and employment between OECD metro-regions and their national average (2005)



Source: OECD metropolitan database, 2009

Through the concentration of population and economic activities, urban areas are also responsible for the consumption of the bulk of the world's energy and thus perhaps the single largest "source" of global CO_2 emissions. Although detailed harmonised data is not available at the urban scale, a recent IEA analysis estimates that 60-80% of world energy use currently emanates from cities. Even if per capita energy use in urban areas is typically lower than in rural areas, urban energy use is projected to grow dramatically in coming decades. The IEA estimates that by 2030 cities will account for 87% of the energy consumption in the United States, up from 80% in 2006 (IEA, 2008). Within the European Union, projections suggest that urban energy consumption will rise from 69% to 75%, and in Australia and New Zealand, from 78 to 80% (IEA, 2008). However, the largest increase in energy use is expected in cities in emerging and developing countries in Africa and Asia. In those countries, the preponderance of urban energy use is likely to shift from possibly CO_2-neutral energy sources (biomass) to CO_2-intensive energy sources, producing a significant impact on CO_2 emissions (IEA, 2008). In China, cities already account for 75% of the country's energy consumption (a figure that is projected to reach 83% by 2030) (Dollar, 2008).

Sprawling spatial patterns are partly responsible for higher emission intensity and emissions in urban areas, also generating greater capital costs and other forms of environmental stress. Research indicates automobile dependent development patterns have led to urban sprawl — that is, low density developments characterised by scattered and discontinuous "leapfrog" expansion, which in turn has led to carbon-intensive communities (OECD, 2001). Empirical work on sprawl applied scenarios based on estimates of uncontrolled (sprawl) and controlled development (some sprawl allowed, but overall more compact, higher-density growth) for 15 economic areas in the United States (Burchell *et al.*, 2002). The study found that sprawl would result in USD 227 billion in additional costs in the United States over a 25-year period compared to a high density option. Such a spatial structure in Cape Town, for instance, helped created an enormous 100km commuting radius and a large ecological footprint, requiring a land mass equal to the size of Greece to provide its inputs and to process its waste (OECD, 2008, Territorial Review of Cape Town).[6]

Changing climate at the global level and the impact on cities

Climate change will have physical and economic consequences across numerous and diverse human activities (Table 1). The impacts literature provides a wide range of estimates on cost of climate change damages under scenarios of policy inaction and on the benefits of action. When combined with understanding about the costs of action to avoid dangerous climate change and uncertainties of various types, it is possible to draw some strong policy conclusions. In particular, in a recent OECD review, two features of global climate change impacts are shown to justify near-term mitigation action -- their irreversibility and the risk that they are extreme, or even catastrophic –, even if the estimated marginal cost of GHG mitigation exceeds the marginal damage cost (Jamet & Corfee-Morlot, 2009). This is because when facing large uncertainties, limiting the risk of worst-case, long-term outcomes becomes a priority that makes near-term mitigation action more valuable. OECD analysis suggests that there is an urgent need to get started today to achieve early, cost-effective mitigation action, and to combine that with cost-effective adaptation (Burniaux, Duval *et al.,* 2009; OECD 2009a).

With respect to cities, to the impacts of climate change may be significant. These include increased intensity of heat waves, with direct effects on human health particularly in cities, where an urban heat island effect compounds rising mean and extreme temperatures driven by climate change (see below); increases in intense rainfall events, which increase the risk of inland flooding; retreat of mountain glaciers, with impacts on water availability and quality in urban regions; and an increased risk of drought and water shortage in already dry regions (IPCC, 2007b). Furthermore, changes in temperature and the hydrological cycle will most likely shorten the maintenance and replacement cycle for key infrastructure (*e.g.* energy

[6] .In other words, if everyone lived as people do in Cape Town, 2.3 planets would be required, a rate comparable to Canada (Gasson, 2002; cited in Swilling, 2006).

production, transport, etc.) as well as influence their operational capacity (*e.g.* brownout and blackouts; service interruptions) if not addressed in the design of infrastructure (Mansanet-Bataller *et al.*, 2008; Cochran, 2009). Beyond this, there are a range of impacts that may be particularly prominent in cities, ranging from effects on human health to those on real estate and tourism (which may be positive or negative). Yet not all climate change impacts are fully quantifiable, which presents challenges to the policy community, especially at urban scales.

Table 1. Types of impacts with a few examples of impacts in cities.

Impacts	Direct			Indirect
	Climate mean changes	Climate variability changes	Catastrophic changes	
Market	Decreased/Increased energy consumption due to heating/cooling demand Rise/fall in tourism due to higher temperature Asset losses due to mean sea level rise (V)	Asset losses due to hurricanes or storm surges (V)	Major asset losses due to catastrophic sea level rise	Effect of the decline in tourism on the city economy. Fall in worker productivity because of health problems Spatial or sectoral diffusion of economic losses into the wider economic system (*e.g.* through disruptions of lifeline services, following a storm surge) (V) Effects on long-term economic development
Non market	Increased mortality and morbidity from, *e.g.* development of vector borne diseases due to increase in global mean temperature Loss in thermal comfort in the city. Population at risk because of sea level rise (Q)	Number of deaths because of more frequent heat wave and thermal stress. Population at risk in coastal cities because of increased storminess (Q)	Cultural losses and migration, including ethical aspects induced by catastrophic sea level rise	Effect of climate change induced water shortages on mortality and morbidity Inequality deepening; loss of human security and inter/intra state conflict

Notes: V = valuation in monetary terms; Q = quantitative metric but not in physical rather than monetary terms. Those impacts that can be valued in monetary terms are marked with a (V); these include mostly direct and indirect market impacts. Some non market impacts, such as the population at risk of coastal flood, will also be quantified (Q), *i.e.* they are expressed in physical terms, but not valued. This includes the reporting of risks to people and assets (*i.e.* flood risk) through the use of physical metrics such as "number of people at risk of flooding" and "size of land area" at risk.

Source: Hallegatte *et al.* (2008).

Changes in the frequency and/or intensity of extreme weather events will be important for city managers and yet this is poorly reflected in the (quantitative) impact assessment literature. The European heat wave in 2003 demonstrates this point; it had dramatic consequence in many urban centres most notably in Paris (Beniston, 2004; Schaer *et al.*, 2004; see also Box 1), and the landfall of Hurricane Katrina in the city of New Orleans in 2005 (Hallegatte, 2006). Given that these types of extremes could become more common with a changing climate, there is some effort to incorporate their consideration in city-scale vulnerability and adaptation assessments (see Hallegatte *et al.*, 2008 for a review).

Urban centres may also be particularly vulnerable to some of the distributive impacts of climate change. Poor populations in both rich and poor nations are expected to be the most vulnerable to climate

change in part due to the lack of access to capital and capacity to respond in a timely manner. As Hurricane Katrina, climate extremes may hit wealthy nations but can still fall the hardest on the poor (Mathew, 2007), who lack the resources to respond quickly and effectively to protect themselves from extreme weather patterns. The urban poor may also be more exposed to climate change, since they are likely to occupy the least-expensive land, sometimes illegally, such as the un-developed floodplain areas such as the Dharavi slums in Mumbai and the New Orleans' 9th Ward (Corfee-Morlot *et al.* 2009). They are also more vulnerable when poor communities use cheaper materials to build dwellings, often violating building or safety codes. This may increase vulnerability to storms or natural disasters as was shown by the collapsed structures from the Sichuan earthquake (2008), the Kashmir earthquake (2005), and Hurricane Mitch (1998). The high vulnerability of the urban poor to climate change makes city actors central in the design and implementation of anticipatory adaptation action.

Finally inaction will also commit us to a rapidly changing climate and possibly to a range of climate "surprises". For example, recent assessments suggest there is a plausible risk that even low levels of temperature change (*e.g.* 1.5 C above pre-industrial levels) could induce melting of the Greenland ice sheet and possibly the West Antarctic, an extreme, but not altogether unlikely scenario, that could raise sea levels by as much as 7 meters over centuries to come and effectively flood many of the world's existing coastal cities (Hansen, 2007; Rahmstorf, 2007). Yet large uncertainties about prediction of such extreme or catastrophic events prevent explicit quantification of their probabilities and inclusion in empirical studies.

Urban specific climate impacts - hot spots

Cities are also home to a number of unique impacts that need to be considered carefully in preparing adaptation plans and in assessing the benefits of global mitigation strategies (Hallegatte *et al.* 2008). For example, an analysis of the local climate in large urban areas is important due to their micro-climates and the impacts of the urban heat island (UHI) effect through which temperature increases resulting from climate change are expected to disproportionately impact cities (Corburn, 2009; Oke, 1987; see also Box 1). Some cities, particularly those on small islands or on the coast, are already visibly affected by climate change. The kinds of impacts they are experiencing range from the physical, such as infrastructure damage from flooding due to sea-level rise and heightened storm surge, to more socio-economic problems, like altered real estate markets and declining tourism.

Box 1. Climate change, urban heat island effect, air pollution and health

An UHI refers to temperatures that are often warmer downtown in comparison with the outskirts of the city. The UHI effect is suspected of warming urban areas 3.5–4.5°C more than surrounding rural areas and is expected to increase by approximately 1°C per decade (Voogt, 2002). The built environment, including buildings and roadways that absorb sunlight and re-radiate heat, combined with less vegetative cover to provide shade and hold cooling moisture, all contribute to cities being warmer and susceptible to dangerous heat events (Corburn, 2009). The temperature differences can reach up to 10° C for large urban agglomerations and can strongly amplify heat stress, especially at night during heat waves, which in turn can lead to serious consequences in terms of public health. This was the case in the 2003 European heat wave, which caused more than 70,000 casualties with higher percentage of victims in urban areas for example in France (Evin *et al.*, 2004; Rousseau, 2005; Hallegatte *et al.*, 2008).

Climate change can also affect urban air pollution on many fronts. The most obvious result is that warmer temperatures due to climate change and the urban heat island (UHI), all other things held constant, may increase concentrations of conventional air pollutants, such as ozone[7] and acid aerosols, as well as emissions of particulates and allergens (Aron and Patz, 2001). Moreover, higher temperatures due to climate change may actually make it more difficult to control the formation of some pollutants, such as ozone, which can exacerbate chronic respiratory diseases and cause short-term reductions in lung function (Bernard *et al.*, 2001). One study estimates these effects in New York metropolitan area to increase mortality rates in the 2050s due to ozone related acute impacts of climate change alone (Knowlton *et al.*, 2004; Hunt & Watkiss, 2008).

Altered weather patterns as a result of warmer climate, could also cause a variety of interrelated air pollution problems. A study done by Mickley *et al.* (2004), using a general circulation model climate simulation, showed that the severity and duration of summertime regional pollution episodes in the mid-western and north-eastern United States increase significantly relative to the present; interestingly this is driven by a decline in the frequency of mid-latitude cyclones, whose frequency is expected to decrease in a warmer climate.

Interface between urban socio-economic development and climate impacts

Climate-related disasters may already account for the majority of urban disasters. As a result some cities have a long experience in disaster response. With the onset of some amount of inevitable climate change comes the expectation of more intense weather extremes with intensities or frequency that go beyond the range of historical observations. This raises the urgency for urban and regional authorities to strengthen capacity in the areas of emergency planning and disaster preparation.

One critical issue is to understand the urban development interface with climate change, easily demonstrated by the example of development patterns in coastal zones. A large proportion of the world's population resides in coastal zones, which are likely to be hard hit from rising sea levels and intensifying storm surges.[8] Recent OECD work shows how a 50-cm sea level rise due to climate change combined with socio-economic development patterns could lead to a tripling of the population exposed to coastal flooding by 2070 and a tenfold increase in asset exposure, increasing the value of exposed assets from about USD 3 trillion to USD 35 trillion, *i.e.* from 5% of GDP today to 9% of 2070's GDP (Nicholls *et al.*, 2008; Figure 3). About two-thirds of this increase in exposure is estimated to be driven by socio-economic development whereas climate change (as embedded in existing storm tracks) and land subsidence amplifies the exposure by one-third. The most affected port cities are found not only in rapidly growing developing countries (*e.g.* Kolkata, Shanghai, Guangzhou) but also in some of the most wealthy of countries worldwide, including

7 This refers to tropospheric ozone which is a secondary pollutant formed in the atmospheric through chemical reactions between hydrocarbons (also known as VOCs) and oxides of nitrogen (NOx) in the presence of sunlight. Increased heat increases the rate of transformation thus boosting urban ozone concentrations. High concentrations of ozone have direct negative effects on human health causing both morbidity and mortality (Kunzli *et al.* 2000).

8 NOAA estimates that 53% of United States' population live in coastal regions (Crosset *et al.* 2004).

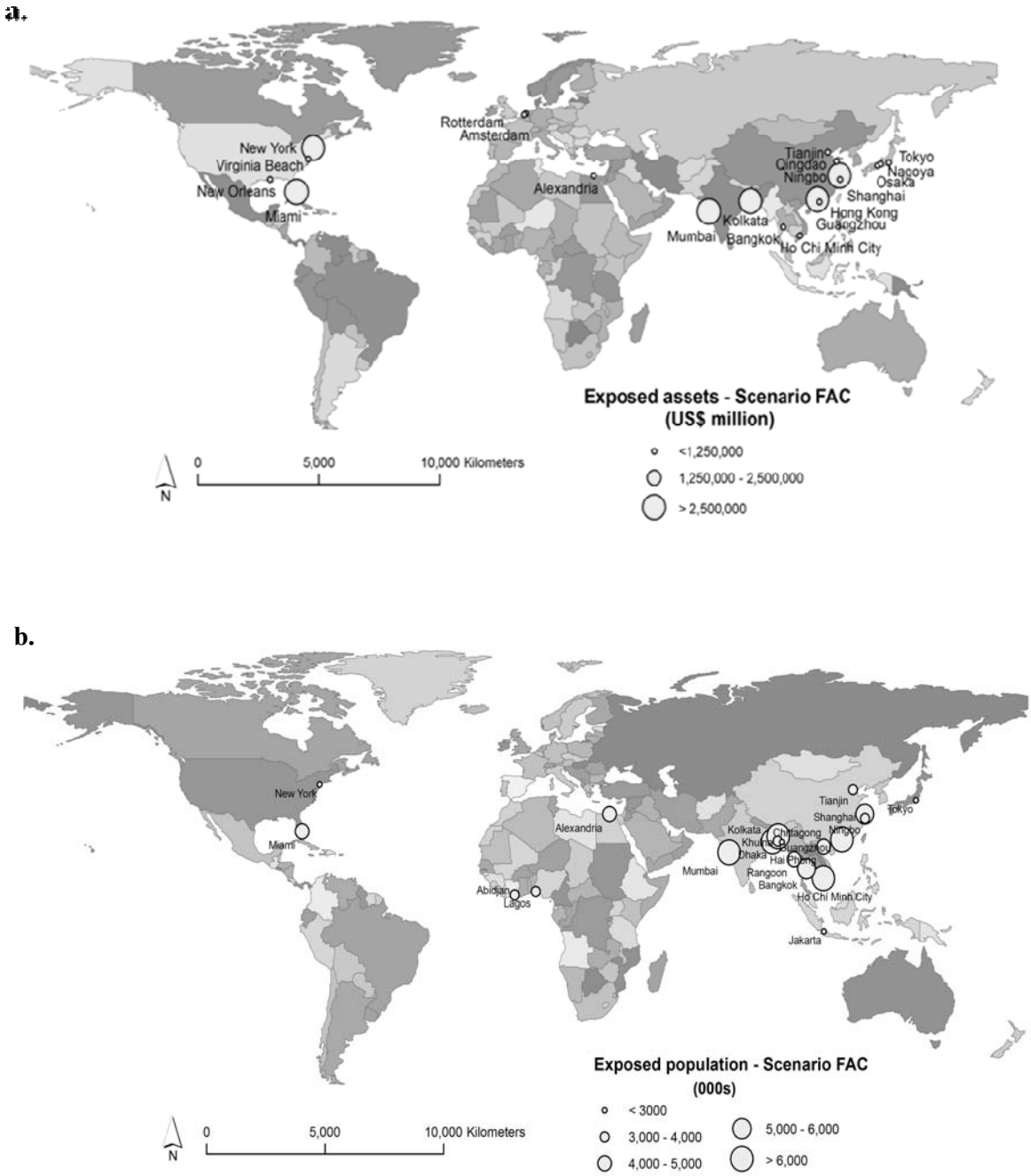
the United States (*e.g.* Miami, New York City), the Netherlands (*e.g.* Rotterdam, Amsterdam) and Japan (*e.g.* Tokyo, Osaka).

The port cities example demonstrates how citizens, businesses, and governments at city, regional and national levels have development choices that will exacerbate or limit the damage that climate change brings. More importantly for multilevel governance, it suggests a number of priorities for local adaptation in port cities. For example, there are potentially large benefits to be reaped through pro-active urban planning and more effective land management to reduce exposure of urban population and infrastructure to coastal flooding, opportunities for adaptation driven changes in infrastructure (*e.g.* drainage systems and sea walls), as well as urban water management policies to reduce land subsidence.

Co-benefits of climate policies at local level

Beyond the potential to experiment and learn through local action, the costs and benefits of policy will be altered by multiple or collateral benefits of climate policy at this local level (Hallegatte *et al.* 2008; Bollen *et al.* 2009). This refers to a range of co-benefits (or costs) in other non-climate change areas. Estimates of co-benefits from mitigation suggest that human health benefits may be large and significantly offset the (local) costs of mitigation (OECD, 2001; Davis *et al.,* 2000; IPCC, 2007b). More recent OECD analysis, indicates that co-benefits of mitigation in a macro-economic context may be highest in OECD countries rather than outside of the OECD (Bollen *et al.* 2009). Many of these national estimates of co-benefits derive from changes at the urban scale, *i.e.* population exposure to air pollution (Cifuentes, 1999, Davis *et al.,* 2000; Kunzli *et al.*, 2000). Table 2 provides an overview of some of the main co-benefits of mitigation policy in urban areas.

Figure 3. Maps showing the Top 20 port cities' exposed assets (a) and exposed population (b) in a future scenario with socio-economic development, subsidence and climate change (FAC scenario).



Source: Nicholls *et al.,* (2008). [Note the different scales in the key].

Table 2. Related aims and co-benefits of sector mitigation policies to reduce GHGs at urban scale

Sector	Climate policy aims and benefits	Other (non-climate change) benefits
Electricity production and industrial energy use	Encourage fuel switching from coal and oil to low or no-emission energy sources, such as combined heat and power, renewable energy and energy efficiency, to reduce CO_2 emissions	Raises urban air quality and limits regional SO_x and NO_x air pollution, preserve water quality, increase energy security, all of which can deliver local benefits
Residential and commercial energy: buildings, office equipment and appliances	Lower energy use requirements of housing and household services, reduce CO_2 emissions	Lower investment costs for energy suppliers and possibly smooth load; lower operating costs for commercial entities and consumers and avoids regional air pollution from (unnecessary) electricity and/or heat generation; improve comfort and affordability; raise energy security
Transport	Raise the efficiency and emission performance of vehicles and manage demand, reduce CO_2 and possibly other GHG emissions	Lower congestion in cities and limit harm to human health from urban air pollution; lower dependency on oil imports to raise energy security. However co-costs may also exist *e.g.* increased diesel fuel use lowers CO_2 but increases particulates, which have human health risks; also catalytic converters lower NO_x emissions but raise N_2O and CO_2 emissions
Waste	Minimise waste, increase recycling and material efficiency in production and packaging, reduce CH_4 emissions	Limit needs for costly and unsightly landfilling; improve economic performance

Source: Hallegatte et al. 2008 – as adapted from earlier OECD work.

A range of activities oriented towards reducing poverty, improving nutrition and education, promoting sustainable livelihood opportunities, and improving climate change information will enhance local adaptive capacity to respond to climate change impacts. However, while adaptation at the local level is important for sustainable development, it is not easy to generalise the process through which this occurs or should be facilitated (OECD, 2009b).

Non-climate co-benefits or co-costs also need to be considered when assessing benefits from adaptation measures (Hallegatte *et al.* 2008). Sometimes, the non-climate-related benefits are sufficiently large to justify the implementation of the measure. In such cases, the measure is said to be a "no-regrets" strategy. For instance, targeting efficient and redundant energy supply networks to avoid blackouts during extreme heat improves the robustness of the energy supply system generally, in which case it protects against non-climate risks, such as a terrorist attack or a purely technical incident.

Aim and approach

This paper aims to develop a multilevel governance framework to explore the linkages between national, regional and local policies to address climate change. It considers the question of "what is good practice?" in the area of multilevel governance and climate change with a particular emphasis on the role of regions and cities. The approach taken in the paper is multi-disciplinary, attempting to combine insights drawing on environmental science; environmental, regional and urban development policy; and a variety of economic and political-economy issues concerning the interface between regional and urban planning and climate change.

The paper begins in Section 1 with an outline of a conceptual and methodological framework for the paper. Section 2 focuses on the horizontal dimensions of governance at regional and local scale. Section 3 reviews local-national linkages in the development of climate policy, which is referred to here as the

vertical dimension of multilevel governance. Section 4 reviews key institutional perspectives, focusing in particular on key ways that national governments may facilitate capacity building and decision making at local level. The conclusion provides policy recommendations. Details on many of the examples cited in different sections of the paper can be found in the Annexes A and B.

2. MULTILEVEL GOVERNANCE: A CONCEPTUAL FRAMEWORK

A multilevel governance framework provides a starting point for understanding how central governments and other public and private actors interface to design and implement policies from international to national and local levels of action (Hooghe and Marks, 2003). This has been widely developed and used by the OECD to assess the performance of cooperative frameworks in nations as well as metropolitan and rural regions (OECD Territorial Reviews). Regardless of the constitutional form of government, multilevel governance calls for a narrowing or closing of the policy "gaps" among levels of government via the adoption of tools for vertical and horizontal cooperation. The OECD framework endorses, for example, the use of performance indicators, a variety of forms of fiscal grants or financing mechanisms, and the use of contracts between levels of government (OECD, 2005; 2007; 2009a). These tools help improving coordination among stakeholders and building capacity in particular at the sub-national level (OECD, 2009 Policy Brief: Bridging the gaps between levels of government). This approach is currently being applied to enhance an integrated approach of water policy (forthcoming synthesis report on water governance across levels of government, 2010)

Multilevel governance also provides a flexible conceptual framework to understand the relationships between cities, regions and national governments across mitigation and adaptation policy issues as well as across a widening range of non-state and non-governmental actors[9] (Marks, 1993; Betsill and Bulkeley 2004; Bulkeley and Schoeder, 2008; Corfee-Morlot, 2009). Public interest in climate change in the 1980s may have emerged initially through international and national science-policy interactions (Corfee-Morlot *et al.*, 2007), however it has become increasingly evident that regional and local decisions are essential in the design and implementation of mitigation and adaptation strategies to respond. This is because greenhouse gas emissions are the result of actions or processes that occur in a given place and, while national and international policy frameworks can mandate and co-ordinate action, a multitude of local-level actions will ultimately be needed to alter future emission pathways over the long-term. Also climate change impacts are felt locally; thus adapting to climate change will also require a wide variety of local changes. As with climate mitigation, adaptation may be guided through nationally led mandates, but its implementation will be inevitably local in character. Of course, key information and specific knowledge gained from local experimentation can also contribute to the design of policy at the central level.[10] (OECD, 2007 Linking regions and central government: the use of contracts for regional development; OECD 2009 Governing Regional development policy: the use of performance indicators)

Attempting to understand the political economy of climate change policy using a multilevel governance approach helps to break down a state-centric understanding and to better characterise the relationships between different actors horizontally across and vertically between different levels of government. In contrast, much analysis of climate change policy has taken an international regimes-based

[9] The word "state" here refers to nation-states – not to be confused with sub-national regional or state government authorities. Overall, many have argued that the authority of (nation-)state actors is considerably weaker today than it has been in the past on issues of public concern (Sathaye *et al.* 2007. These patterns put emphasis on "governance" rather than on "governments" as a centre for social research on global environmental change and decision making.

[10] For example, see the approach suggested in OECD (2009) *Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation.*

approach and focused on the establishment of international treaties as a main driver of change (Haas *et al.,* 1993; Paterson, 2008; Young, 1989). Focusing on climate change in particular, we suggest that these relationships also span multiple levels of government and governance, involving different configurations of actors and priorities depending on the scale and scope of decision making.

Any multilevel governance framework will encompass at least two different dimensions of action and influence and both warrant attention: the first is the vertical dimension across scales or levels of governance and the second is the horizontal dimension of governance (Bulkeley and Betsill, 2005; Hooghe and Marks, 2003; OECD, 2006).

The vertical dimension of multilevel governance recognises that national governments cannot effectively implement national climate strategies without working closely with regional and local governments as agents of change. On the other hand, to take action, cities cannot be effective and do not operate in isolation from other parts of government. Local governmental authority to act in areas related to climate change is often "nested" in legal and institutional frameworks at higher scales (Dietz *et al.,* 2003; Hooghe & Marks, 2003). For example, while regional and local policies determine the specific details of land use, human settlement patterns and transportation planning, the space for action and potential for change is usually limited by national development paths, national policies and technical standards and national budgets and funding priorities (Sathaye *et al.*, 2007). This suggests that action at local scale may enable or constrain what is possible nationally and vice versa, highlighting a two-way relationship between local and national action on climate change. Economic aspects are also key. In particular, externalities and spillovers of local policies are often used as a key argument for supporting improved coordination between levels of government and the search for a "relevant scale" for allocating public responsibilities and resources.

On the horizontal axis, there is increasing evidence of multi-level patterns of governance and transnational networks on climate change and other global environmental issues where actors work across organisational boundaries to influence outcomes. Within the multilevel regulatory framework, learning, information transmission and cooperation also occurs horizontally with linkages increasingly being forged between cities, regions and national governments (Bulkeley & Moser, 2007). At the sub-national level, some of these horizontal relationships have been created through formalised information networks and coalitions acting both nationally and internationally, including ICLEI's Cities for Climate Protection, the Climate Alliance, the C-40 Large Cities Climate Leadership Group, the U.S. Mayors Climate Protection Agreement, among others.[11] These groups have given an institutional foundation to concerted effort and collaboration on climate change at city level (Aall *et al.*, 2007).

Horizontal coordination at the local level is not just about international associations of local authorities. Above all, it concerns different forms of coordination among local jurisdictions that belong to the same urban metropolitan area or the same rural area or between urban and rural areas. Urban regions are characterised by a strong institutional fragmentation while many strategic decisions need to be made, and services provided, at this level (OECD, 2006). This element is very important for urban development policies in general and environmental issues in particular. Speaking about the "horizontal dimension" of multilevel governance is also very often associated with the need for improving coordination across line ministries at the central level for dealing with cross-cutting policies, which is particularly the case on environmental issues. On issues of climate change, cities and other local governments hold the unique potential to work closely with local constituencies to develop visions of the future that match the needs of

[11] For example, ICLEI's Cities for Climate Protection network has been extensively analyzed in the literature (Aall *et al.* 2007; Betsill & Bulkeley 2004, 2006; Lindseth 2004). One of the first networks established, it counts over 680 cities as members from over 30 countries worldwide.

these constituents while also addressing climate change (Brunner, 1996; Moser & Dilling, 2006; Cash & Moser, 2000).

Horizontal governance patterns also include the notion of issue-based governance[12] where often overlapping jurisdictions address key issues separately and in parallel with other decisions on other pieces of the climate change puzzle (Hooghe and Marks, 2003; Gray, 1973). These may include a range of policy issues with significantly earlier and deeper historical foundations than climate change, *e.g.* in the areas of energy efficiency, air pollution or water management, where there may be separate instruments or mechanisms (Corfee-Morlot 2009). Instruments may include joint powers agreements, separate commissions, regional councils or boards, annexation, metropolitan districts, metropolitan governments, tax-base sharing and redistributive grants, and informal cooperative mechanisms (OECD, 2006; Walker, 1987). Horizontal governance activities thus increasingly also include giving "voice" or influence in the policy dialogue process to business, research and environmental non-governmental organisation.[13] One prominent example of this is the broad evidence of non-governmental actors in a range of activities related to climate policy from the generation of ideas to formulate policy to a "watchdog" role to assess how well policies are performing with respect to the stated goals of policy (Weiss Brown, 1998; Levy & Newell, 2005; Gough & Shackley, 2001).

Local-scale action allows for an interface between experts and local stakeholders to build understanding about how climate change may affect local development choices and how those choices will affect the future climate. However for this to be possible, a number of different pre-conditions must hold: the existence of some autonomy in regional strategic planning as well as the institutionalisation of a dialogue with private (citizens, associations, firms, and other relevant local stakeholders). Through this type of local deliberative exchange, social norms may evolve, for example about how climate protection fits with visions of future development; this can make it possible to garner bipartisan political support for policy reforms and action.

In adaptation local actors should both benefit from and shape adaptation decision making at other levels in order to ensure successful adaptation action. Lessons and experiences with adaptation at the local level must feed into higher levels of decision making to make sure that local strategies remain relevant and appropriate, and provide a basis for transferring knowledge to other sectors and communities. Effective communication channels, institutions that support innovation and experimentation, and meaningful participation from community-level actors are central to achieving this objective (OECD, 2009e). Inevitably local action on climate change will facilitate identification of specific obstacles to action and enable the design of targeted solutions to overcome these, whether the solutions are grounded in local or higher levels of action.

Key obstacles to the effective design and implementation of policies at local level range from issues of authority to resources and capacity. In particular there may be a lack of devolved authority in many relevant areas from buildings to transport. There may also be political tension between national and local policy priorities and different preferences for change. There may be overall failure to diffuse incentives for change through the market system, with climate change being dealt with in only a narrow way through a sub-set of policies targeting a limited range of actors or investments. This will slow change and limit the cost-effectiveness of climate policy initiatives across levels of government. There will also be a need to consider the legal and regulatory frameworks at the disposal of sub national governments and to examine how these can be aligned to integrate climate change considerations. Last but not least there may be the

[12] An example of issue-based governance is where an institutional structure is in place to govern water resources, or air quality at regional scale covering one or more municipalities.

[13] These are also fondly known as BINGOs, RINGOs and ENGOs, representing business & industry, research and environmental non-governmental organisations, respectively.

lack of coordination among line ministries taking purely vertical approaches to cross-sectoral policies that can require co-design or implementation at the local level.

Methodology and key questions to structure the analysis

There is therefore a need to consider cities-scale action on climate change within a multilevel governance framework and within this to focus on the question of: What is good practice? In particular, the analysis that follows examines the main research question of what general recommendations can be made to governments regarding multilevel governance on climate change. This is examined in three parts:

1. How is climate policy playing out across local levels or horizontal levels of governance? Is it working well and if so why?

2. What are different national-local linkages or vertical governance approaches to deliver GHG mitigation and/or climate adaptation? What are the key institutional models and within these features of "good practice"?

3. What are the key tools for good multilevel governance of climate change? Are they in place and effectively functioning to support cost-effective local decision making on climate change? If not, what is needed to ensure that appropriate tools are in place?

Overall, it is necessary to probe the notion of "good practice." This paper begins to review and test the usefulness of a number of principles or criteria for good practice that can be broadly drawn from previous OECD work in the fields of environmental and regional/urban development policy respectively, and from the brief literature review included here. These principles include:[14]

- **Ensure participatory governance and strategic planning at relevant scale:** Does the policy framework stimulate reflection and understanding across a broad cross-section of local stakeholders about how climate change and climate protection policy will affect the local communities and development and help to shape a way forward to integrate climate protection and resilience into urban development planning? How is citizen engagement and participatory development included in the approach to climate policy design?

- **Provide an analytical foundation for short and long-term planning:** What internal as well as external 'know-how' exists on climate change mitigation and adaptation issues and is adequate use made of available resources? Is research policy relevant, *i.e.* is it sufficient, regionally or locally tailored and in an accessible form to support sub-national decision making? Are planning structures in place to incorporate long-term issues raised by climate change research?

- **Deliver cost-effectiveness and economic efficiency:** Will the policy(ies) or planning practice(s) lead to least cost investments to achieve a given climate goal/target? Does the policy mix rely upon an appropriate mix of instruments, including market to guide private investment to least-cost outcomes? To what extent are direct as well as indirect impacts (costs and benefits) of climate change policies as well as both mitigation, adaptation and risks of inaction considered in the design of policies?

- **Encourage experimentation and innovation, particularly at local and regional levels of governance**: How can national governments encourage experimentation and learn from such experience? How can the unique opportunities for local scale innovation be incentivised and

[14] See also Beck *et al.* 2009 and Kivimaa and Mickwitz 2007 for a discussion of similar issues.

monitored to draw lessons either to improve policies in other local context or more broadly diffused through regional or national policy frameworks?

- **Address distributional consequences and procedural equity**: How will the policy(ies) affect the poorest in the targeted community? Does it lead to good access to information and decision making across all segments of the targeted population?

- **Establish a long-term planning horizon:** Climate change action planning is a project that unfolds over the long term. It therefore demands continuous commitment and political vision. How can policies and practices be designed that transcend the political cycle and embody a long-term, future-oriented vision?

- **Deliver policy coherence:** How do we align incentives in a pro-active manner to deliver climate protection and resilience, working both vertically across levels of government, and horizontally across different actors and issues within a given scale of governance. Have the potential contradictions and synergies between the aims related to climate change mitigation and adaptation and other policy goals been assessed? Have there been efforts to minimise contradictions and exploit and expand on synergies? Has there been an effort to integrate climate change action to be compatible with other policy priorities?

- **Conduct monitoring, reporting and evaluation:** Are there clearly-stated evaluation and reporting requirements for climate change mitigation and adaptation policies to allow performance assessment (including deadlines) ex ante? To what extent has performance assessment occurred? Have indicators been defined, followed up and used to assess performance?

Some of these principles may be more important and practical to pursue at one scale versus another – *e.g.* equity and participatory governance practices may be more meaningful at local scales of decision making than for national policy and decision making. With respect to coherence, a positive outcome will depend upon local contexts and starting points and must be assessed by looking at the balance of outcomes across new actions to address climate change and pre-existing incentives and outcomes in related areas (*e.g.* urban development plans, transport and/or energy policies). Feasibility of any multilevel governance proposal or action is also to some extent going to be determined by whether the new action can be well integrated into existing practices in related areas.

3. LOCAL AND REGIONAL GOVERNANCE

Increasing role of local and regional governments in climate change policies

While the international community has been struggling to agree on common objectives and targets to fight global warming, a growing number of cities and regions have taken initiatives to reduce their energy use and CO2 emissions. In recent years, there has been a gradual involvement of urban political leaders in climate change policymaking. Many cities have set targets for greenhouse gas (GHG) reductions, some beyond national commitments, or in the absence of national action. They include for instance, London, which in its Climate Change Action Plan, established in March 2007, calls for a 60% reduction from 1990 to 2025; New York's A Greener, Greater New York campaign, set up in April 2007, calling for a 30% reduction from 2005 to 2030, and Tokyo's Climate Change Strategy, established in June 2007, calling for a 25% reduction from 2000 to 2020. Through the U.S. Mayors' Climate Protection Agreement, more than one thousand mayors have agreed to meet or exceed Kyoto Protocol targets even though the U.S. government has not ratified the Protocol.[15]

Many local communities have started to take action. There has been a relatively rapid growth in the response and development of climate policies by local, regional and state governments throughout the world, especially within the OECD. This is visible among major metropolitan centres, such as New York, London, Paris, Tokyo, and Seoul, and to a lesser extent among medium and smaller-sized cities and towns. The range of actions includes savings in energy use, renewable energy resources, public transportation, infrastructure design, land use planning and zoning, and waste and green procurement programmes. In some cases, sub-national climate initiatives often exceed the targets set by national governments. In Stuttgart, for instance, the city has set up stringent regulations for building above national standards. In the U.S., the State of California is allowed to enact stricter environmental regulations for vehicles under the U.S. Clean Air Act, on the basis of both unique health and welfare risks presented by air pollution in its context as well as of the size of its economy; other U.S. states can opt to adopt more stringent California standards or the federal standards. More recently California was granted permission to implement vehicle standards that target CO_2 emissions by improving the combustion efficiency of vehicles. The first of their kind in the U.S., these regulations, together with several other pieces of legislation enacted by the State of California, constitute the most ambitious and comprehensive effort to mitigate climate change in the U.S. (Bulkeley and Schroeder 2008; Corfee-Morlot 2009).

Paralleling this development, joint commitments among local governments within countries are also emerging, such as the Nottingham Declaration, signed by 200 local authorities in the United Kingdom. Cities and regions are working together in transnational networks to strengthen their greenhouse gas reduction efforts. ICLEI, Local Governments for Sustainability, for instance, includes more than 1 074 local governments and their associations, representing more than 300 million people in 68 countries. Today, more than 890 of ICLEI's members have committed to reducing their CO2 emissions to 20 percent below 1990 levels within the Kyoto framework of 2010-2012. As will be developed in the next chapter, there are now a dozen or more international networks for local initiatives on climate change and sustainability.

[15] As of October 2009, 1 012 U.S. Mayors have signed the agreement. See www.usmayors.org/climateprotection/list.asp.

Sub-national governments (cities and regions) are well positioned to develop policy and programmatic solutions that best meet specific geographic, climatic, economic, and cultural conditions. There are many governance decisions that are typically made or strongly influenced by decisions at local and regional levels (Table 3). Urban authorities make decisions that determine or influence public transportation systems, land use planning, construction, renewable energy use, energy efficiency measures, waste and water management, and local education campaigns.

Table 3. Local-Level Mitigation and Adaptation Policies Across Sectors

Sector	Mitigation	Adaptation
Building	Energy efficiency measures	Adaptability in changes in climate extreme
Electricity Generation/Distribution	Fuel mix; use of renewable; transmission loss	Robustness of electricity infrastructure
Heating/Cooling	Energy demand management; renewable energy use	Robustness of cooling / heating infrastructure; Exacerbation of heat island effect
Waste Disposal	Shipping of waste; Methane emissions mitigation (capture/co-gen)	
Transportation	Modal mix; Vehicle efficiency;	Effects of climate on infrastructure (roads, mass transit systems); Changes in use patterns
Land-use planning	Land-use regulation (increased density, increased proximity); Energy efficient development	Land-use regulation (reduce development vulnerability);
Water Provision	Emissions related to pumping	Long-term availabilities studies; water use measures

Sub-national government's policies can also have global impact, particularly through world trade. For example, with the passage in California of AB32, the Global Warming Solution Act, California may be in the process of putting itself at the forefront of not only U.S. climate change policy action, but international as well (Mazmanian, Jurewitz, Nelson 2008; Rabe, 2009). The California case underscores the potential to create a "virtuous policy circle", where early environmental action creates capacity for further change. When initial action has occurred in areas related to climate change (*e.g.* energy or air pollution), as was the case in California, climate policy action is a natural evolution from past pro-environmental policy (Corfee-Morlot, 2009).

In this chapter, we discuss the means by which cities, states, and other subnational governments develop and implement policies to mitigate their impact on climate change and adapt to its effects. We first consider each stage of the policy process and explore the obstacles local and regional governments face at each stage of the policy process. Then, we discuss issues related to urban and regional governance which typically hinders policy development and implementation in urban areas.

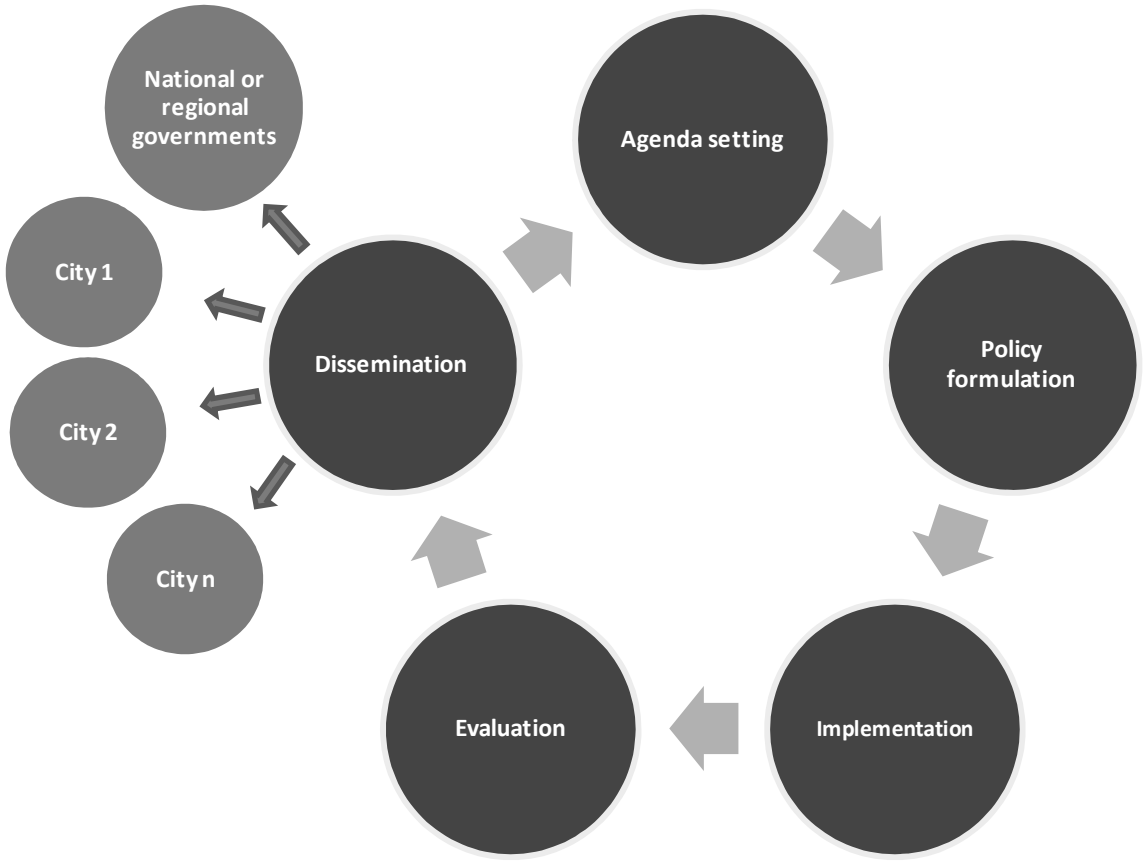
A number of cities and regions have formulated explicit climate change action plans but it is important to note as well that a number of states/regions and cities have taken initiative related to climate change in the absence of explicit plan, adopting greening building policies and renewable portfolio standards for utilities. There has been a proliferation of climate change action plans and programmes at the local and regional levels.

The public policy process: The planning behind climate change action plans and policies

Though local and regional governments across the world have elaborated a wide variety of climate change actions and plans, the development and implementation of these often follow a common policymaking continuum. To better analyze the policy process, this paper will employ a simplified Stages

Heuristic framework (Jones, 1970; Anderson, 1975; Brewer and De Leon, 1983). According to this framework, the stages of policymaking can be divided into roughly five stages:[16] agenda setting, policy formulation and approval; implementation, feedback evaluation, and dissemination of ideas and replication elsewhere. The climate change policymaking will be analyzed at each one of these distinct phases. The policy process stage framework, which is discussed in more detail below, offers an opportunity to both better understand how climate change policies are being made at a local level, to identify the most severe obstacles that arise in each phase, and to address these. In so doing, this section helps answer two questions proposed by this paper: (1) "How is climate policy being designed, implemented and evaluated across scales of government?" and (2) "How could multilevel climate policy designs be improved?"

Figure 4. Stages in the public policy process



(1) Agenda setting

There are several motivations and drivers behind sub-national actions and strategies. In many cases, political leadership has been the most important factor in developing climate action plans. This often requires a legal requirement. For instance, in London, under the Greater London Authority Act 2007, the Mayor was given a "new statutory duty to contribute towards the mitigation of, or adaptation to, climate change in the UK" (GLA 2008). This legal requirement to address climate change provides a platform upon which to build future strategies. A drawback of politically driven climate plans is that they are subject to local term elections.

[16] Note this framework is slightly adapted particularly to include a dissemination stage.

Support from the business sector and general public provides another driver for the adoption of a climate change action plan. This support may take the form of a positive climate of public opinion or a lack of overt opposition from key interest groups. For instance, the City of London Corporation has played a role in developing and representing business interests in carbon markets. In other cities, policy networks and research groups have been critical to launching a climate agenda, a theme that will be more fully explored later in this paper.

A triad of reasons motivate local governments and regions to act on climate change. These include growing concern among local leaders about the long-term human health or social and environmental effects of inaction as well as the possibility to piggy-back climate change onto more urgent local agendas such as improved local environments and liveability of cities. Beyond a range of negative local public health and environmental deterioration risks emanating from climate change there are potentially large co-benefits to be reaped from both mitigation and adaptation action (see section 1). Key areas include reduced air pollution and congestion in urban areas with subsequent benefits for human health and liveability of cities.

More recently, economic motivation has gained importance through the promotion of energy independence and security, especially in contexts of increasing oil prices and diminishing resources. Improving energy efficiency through replacement of lighting, building retrofits and insulation have been identified as the most cost-effective means for reducing greenhouse gases (McKinsey & Company, 2007). In most cities and regions, there is still tremendous room for energy-efficiency improvements, through better insulation in existing housing stock, use of fluorescent light bulbs in place of incandescent ones, capturing of waste heat from industrial activities, reducing the number of unnecessary miles travelled, having local industries look at what they can do to cut back in the waste they produce.

There is also a growing recognition that the greening of cities can lead to new jobs. The argument is that the economic benefit associated with a large number of mitigation activities (energy efficient devices, green building, etc.) act as an incentive to generate new markets for new technologies and new consumer markets in urban areas. A study conducted by the United Nations, "Green Jobs: Can the Transition to Environmental Sustainability Spur New Kinds and Higher Levels of Employment?" suggested that a silver-lining in the climate change story will be the creation of millions of new green jobs in green manufacturing, green construction, and green energy. The report predicted that in Germany environmental technology will quadruple over the coming years, reaching 16% of manufacturing output by 2030 and employing more people than the auto and machine tool industries combined.[17] According to the German Ministry of the Environment, the renewable energy sector alone employed close to 250,000 people and generated over USD 240 billion in annual revenues in the mid-2000s.[18] Following this momentum, in the U.S., the Governor of the State of Washington and legislative leaders announced a comprehensive Green Jobs and Climate Action legislative package, the "Green Jobs and Climate Action Plan" which includes targeted investments in energy efficiency and clean energy sources that will create new jobs for the region. This builds upon previous efforts, such as Vienna's adoption in 1999 the city's climate protection programme (KLIP) as a framework for its eco-business plan[19] or the Kitakyushu Eco Town in Japan (OECD, 2009).

[17]United Nations Environment Programme, "Silver Lining to Climate Change- Green Jobs," Press Release, December 6, 2007; United Nations Environment Programme, "Landmark New Report Says Emerging Green Economy Could Create Tens of Millions of New 'Green Jobs'"

[18]Martin Seiwert, Matthias Hohensee, and Matthias Kamp, "Hot Technology to Protect the Earth," German News No. 1, 27, 2007, pp. 18-23.

[19] The plan was introduced to help enterprises operate and generate profits through eco-friendly practices that benefit both the environment and the economy. 527 enterprises have participated to the Eco-business plan, implementing

Local governments face several obstacles when determining climate change policy priorities. The first type of obstacle is legal related. Questions over jurisdiction can hinder efforts to mitigate the full range of a city's climate impacts. Second, cities may or may not have full control over a number of key areas of decision making. Third, local-level policymaking has also tended to overlook the need for adaptation policies. Ongoing debates over concurrent or overlapping mandates continue to hinder policymaking. In the U.S. state and local governments continue to debate the interpretation of authority to promote growth-control and land-use measures. Richardson (2003) argues that local authorities in the U.S. too conveniently hide behind an obscure 19th century ruling of the Supreme Court (the "Dillon Rule") to escape culpability for deploying land-use and growth control strategies that are necessary to address climate change (Richardson, 2003). He notes that the "Dillon Rule" does not preclude strong action by local authorities when addressing the necessary land-use and growth-management strategies.

Climate change policymaking has been characterised by a lack of focus on adaptation issues. Indeed, to date existing climate change action plan focus on mitigation. In the U.S., only a handful of cities (New York, Seattle, Portland, Boulder) and states (Oregon, Washington State) incorporate both adaptation and mitigation in their responses to climate change. Mexico City has only recently incorporated adaptation actions in its portfolio of mitigation actions.

The successful integration of adaptation into local development processes depends on a number of enabling conditions. There needs to be broad and sustained engagement with and participation of local stakeholders, including local governments, communities, civil society and businesses. Local authorities need to adopt a collaborative approach where local actors are seen as legitimate decision-making agents. In addition, there needs to be greater awareness raising and targeted messaging on climate change, as local actors need to know why they might have to take different decisions or call on different or additional resources in shaping their livelihoods. Furthermore, appropriate information needs to be gathered and used to inform local-level adaptation decisions (OECD, 2009f).

A lag in attention to adaptation in local climate plans may be because it requires a larger upfront research effort, presumably to be sponsored by the public sector and engagement of actors around a relatively new set of issues (*e.g.* water planning for future trends that break from past trends and understanding). However, at least initially adaptation can be sensibly advanced through the integration of concern about climate risk into normal development planning and investment (OECD, 2009f). Mitigation policy, by comparison, is often connected to a number of pre-existing regulatory frameworks where government action is already well established, *e.g.* in the areas of energy efficiency and waste management, and incentives for the private sector to pick up the investment. Moreover, mitigation and adaptation actions can have either synergistic or contradictory effects. For instance, expanding the use of conventional air conditioning to adapt to higher extreme temperatures in cities is likely to drive up the use of energy and the emission of GHG. In contrast, better insulated buildings will both lower the need for air conditioning, energy demand and emissions while helping people to live with the higher temperatures that climate change will bring.

(2) Policy formulation

The development of local policies and action plans typically involve the establishment of an expert body or commission composed of stakeholders and policy leaders who meet to discuss goals, potential areas of action, priorities, implementation strategies and monitoring mechanisms. These commissions are sometimes limited to talk shop places where ideas circulate and when they are more linked to the decision making process, they tend to be more closed process. Sector-specific working groups are usually

---

more than 9000 environmental projects. The eco-business is now being implemented in other cities like Athens, Greece.

established as well from areas such as transportation, energy, housing, waste management and forestry. These working groups may first engage in a "shared diagnosis"[20] of climate change mitigation and adaptation issues, to support subsequent policy formulation. To maximize the potential for useful input and to involve the public in decision making that will affect them, many commissions draft plans with active participation from stake holders—from industry, NGOs, academia, government, homeowners, and the like. This may be done through workshops, lectures, public hearings, or written comments on draft plans of action. In Seattle, the Mayor appointed a "Green Ribbon Commission on Climate Protection." The Commission, which brought together leaders from Seattle's business, labour, non-profit, academic and government sectors to develop local solutions, developed a report and recommendations for local action. This included a metric's sub-committee to develop measures to indicate if Seattle is making progress in meeting its goals and sub-committees for energy, transportation, outreach, and freight. The sub-committees benefited from the work of an earlier commission that had conducted the city's first greenhouse-gas emissions inventory (Box 2).

Box 2. Decision Criteria Used by Seattle's Green Ribbon Commission

In coming up with recommendations for Seattle's Climate Action Plan, the Green Ribbon Commission followed a series of **decision criteria**:

Green house gas (GHG) reduction potential over time: Does the action avoid, reduce or sequester GHG emissions in Seattle (without exporting GHG emissions elsewhere)? Can the GHG emissions reductions from the action be measured? If so, what are they? Does the action provide near-term reductions (*i.e.* before 2012)?

Feasibility: Do cost estimates appear to be reasonable compared to estimated GHG reductions? Is the action technically feasible/how easy is it to implement? Is the action legally feasible? Will the action require new legislation? Has the action been tried successfully elsewhere? Are there likely partnerships that will enhance programme implementation?

Catalytical potential: Is the action likely to influence others to take action (*i.e.* the multiplier effect) and/or does the action result in GHG reductions outside of Seattle? Is it transferable outside Seattle to other jurisdictions, businesses, etc? Is it compatible with or does it enhance the effectiveness of other policy initiatives? Does it have ancillary economic and/or environmental benefits (*e.g.* reduced air pollution, job creation, keeping dollars within the region, etc.)?

Source: Seattle Climate Change Action Plan, www.seattle.gov/climate/criteria.htm.

Prioritisation of actions depends on time horizons, *i.e.* strategies must be matched to the time period targeted in the action plan. For instance, the Northwest region of England developed a Climate Change Action Plan for 2007-2009 and thus was restricted to actions that could be taken over a three-year time frame. Priority therefore was placed on those actions that were likely to have the biggest impact on reducing greenhouse gas emissions in the short term. Local and regional governments trying to determine which strategies to prioritise, often emphasise policies that are politically feasible, financially sound—in terms of "bang for the buck" and will have the largest emissions reductions (See Gallivan, Ang-Olson, Schroeer, Mongioi, Jr., ICF International 2007). Through this process, policymakers determine areas where actions can be taken with multiple benefits. A few governments establish criteria for prioritising greenhouse gas reduction actions. The Darebin City Council in Australia, for instance, provides a useful set of criteria for considering timeframes, benchmarks and methods to allocate resources (Box 3). However, in general, prioritisation is not clear-cut and local and regional plans include an impressive list of actions, as Wheeler (2008) pointed out for the U.S.

[20] In France, this process, known as "diagnostic partagé", commonly comes at the start of the development of a local Agenda 21 framework at local levels to help determine which sustainable development issues to address.

Box 3. Darebin City Council's Criterion List for Prioritising Greenhouse Gas Reduction Actions

The Darebin Council in Victoria, Australia, has decided as part of its greenhouse gas reductions objectives, that the purchase of renewable energy through the Australian GreenPower programme would one of the simplest and most effective means of achieving large scale emission reductions, but requires ongoing annual expenditure. Criteria for prioritising greenhouse action within existing Council Buildings include: (i) Payback within 15 years, (ii) Proposals with larger emission savings to be prioritised; (iii) Where projects have a similar greenhouse impact, projects with the shortest payback period to be prioritised; (iv) Maintenance issues including costs or savings to be considered; (v) Aim for at least 10% of the project budget for the facility to be allocated to ESD initiatives with a priority given to energy efficiency, then water consumption, materials etc. (vi) Design for Greenhouse Neutrality - the cost of achieving greenhouse neutrality for the life of the building to be considered and capital and operating opportunities and costs to be compared (*i.e.* the operating cost of buying 100% GreenPower and offsetting gas emissions for the life of the building) and (vi) Large facilities (more than USD 1 million) to have an ESD consultant appointed (in consultation with Council's ESD Officer) and have electrical and mechanical services reviewed by Council's Energy Efficiency Consultant.

Finally, as part of the planning process, city and regional governments may also develop measurable and verifiable benchmarks against which environmental progress - positive or negative - can be assessed. One of the first tasks is developing a greenhouse gas inventory that identifies emissions from the transport sector, household and commercial energy use, land clearing, waste disposal, and other sources of emissions. Technical expert committees can play a critical role in helping to determine a range of tools to assess performance. As noted in the following section, additional tasks may include setting up systems for developing greenhouse gas inventories.

A main obstacle for policy formulation is that policies have often been developed without an integrated urban planning framework. Many actions seem to be selected on an ad hoc basis according to the feasibility to implement short-term visible actions rather than clear criteria of priorities to obtain effective results. Were climate change goals and recognition of long-term risks of climate change fully integrated into urban development plans, the prospects for effectiveness of "climate change" actions would be improved. In particular local authorities might achieve a better balance between mitigation and adaptation, reduce unintended negative consequences of those actions, and better link urban development objectives with climate change actions. Climate change actions are thus not solely linked to the environment but should be an integral part of urban development strategies. Yet in many cities there is a lack of integration of climate policy into urban planning. For example in Japan, Sugiyama and Takeuchi (2008) found that climate change is treated as a distinct policy issue, rather than one whose solution will require integration of climate change awareness into all policy areas, ranging from transport, to finance, education, and zoning. Integrated planning schemes would be able to better address urban sprawl, which as mentioned in the introduction, is an indirect contributor to CO_2 emissions.

A crucial prerequisite for the creation of climate-proofed urban infrastructure is the implementation of integrated land use and transport policies that allow for compact cities to develop with clusters of high-density nodes. This requires developing an integrated urban planning framework, as land use and zoning may exacerbate or limit exposure and the vulnerability of urban dwellers and infrastructure to the growing threat of climate change. Many of the principles which had begun to be integrated into land use and transport planning, *e.g.* mixed use development, reducing the need to travel, etc. have the potential to reduce emissions, but local climate strategies are not well integrated into the existing planning tools. Indeed, few cities have integrated land use planning and transport other climate related actions. A few pioneering cities, though, could inform the next generation of climate change action planning. In the U.S., the municipality of Santa Cruz has incorporated climate change strategies into general plans. Others like Chicago, Denver, Las Vegas, have included climate change plans, though often with a loss of focus on climate change per se (Wheeler, 2008). Madrid's "Strategic Plan for Efficient Use of Energy and Climate Change Prevention"(2008) has developed a comprehensive approach addressing urban planning, transport,

building, and water and waste management.[21] Correspondingly, urban planning tools, such as zoning and building codes, also need to be adapted to the long-term prospects of climate change.

(3) Implementation

Local governments' capacity to implement climate change policies and action plans is closely linked with their regulatory modes or urban governance. At least four modes of urban governance can apply to subnational governments (Alber and Kern in OECD 2009; see also Table 4).

Self-governing: the municipality as consumer. Sub-national governments can limit their own consumption and ecological footprint through municipal operations management, including such efforts as promoting the energy efficiency of municipal buildings and the greening of public transport vehicles. This is the most widespread form of local action, driven in many cases by the direct financial benefits of energy savings. For example, Los Angeles Mayor Antonio Villaraigosa supported a programme that will replace approximately 160 000 energy-intensive streetlights with energy-efficient light-emitting diode (LED) lights. These targets have been met so rapidly because the City of Los Angeles controls key assets, such as the Port of Los Angeles and the Department of Water and Power, which is the largest public utility in the United States.[22]

Governing through enabling: the municipality as a facilitator. The municipality can facilitate co-ordination with private and community actors, such as by establishing public-private partnerships for the provision of services and infrastructure. For instance, the City of London has established a joint venture between the London Climate Change Agency and EDF Energy to implement a decentralised energy scheme. The city has also created the London Energy Partnership, a consortium of private and public agencies that is developing a range of energy-related measures. The municipal energy plan of the City Council of Venice presents another example of a city government's facilitation of public-private partnerships. The Venice energy plan includes a series of intention protocols involving a number of joint venture projects between private companies, municipal transport companies, housing administrators' associations and associations of planners, architects and engineers.

Governing by provision: the municipality as provider. Governing by provision is accomplished through the use of material and infrastructural means in the provision of direct services (water, electricity, public housing, etc.). By influencing infrastructure development and service delivery, local governments can modify public consumption and waste disposal patterns. A local or regional government can thus impact local climate change action as the majority shareholder in the local utility companies for utilities and other public goods in the field of energy, transport, water and waste services. However, this potential for influencing the supply side of energy has been considerably eroded by the deregulation of energy

[21] This strategy has paid off as Madrid has managed to reduce GHG emissions by 15% over the period 1990-2004, while Spain as whole registered a rise of 47%. Madrid's City Council, exceeding Spain's commitment, released a Plan for the Sustainable Use of Energy and the Prevention of Climate Change last year, promising a 14% reduction of GHG based on 2004 values over the period from 2008-2012. The city has developed its public transport network in recent years, pledged to make municipal transport vehicles environmentally friendly by 2011 and has actively exploited new sources of energy, including the generation of electric power through waste incineration, biogas from landfills and sludge drying. It has also embarked on the renovation of its public lighting system and encouraged a steady rise in the incorporation of solar-powered heating systems in newly constructed and renovated buildings (whose number has increased sevenfold since 2003). In collaboration with the city's economic and social stakeholders represented in the Pro Clima Madrid Forum, a platform that includes all its major private companies, Madrid is promoting biofuel supply networks and an incentive scheme for clean motor vehicles.

[22] In other cities, governments are beginning to adopt "Fifty-fifty" programmes, that encourage public schools, libraries, and hospitals to cut their energy costs. Public institutions in these cities that save over 50 percent of their energy, are free to re-program the savings back into their own budgets.

markets and the privatisation of public utilities may have changed ownership structures and the policy levers for local authorities to intervene in this area.

Governing by authority: the municipality as regulator. Local governments may enact regulations to curb CO_2 emissions if they have legal jurisdiction over relevant policy areas such as energy, transport, land use and waste. Examples include Barcelona's solar thermal ordinance; the introduction of regulations to reduce the fossil fuel use for all new buildings in Santa Barbara, California; and restrictions on the use of cars in Munich and Paris. The extent of such a mode of authoritative governance, however, is closely linked with the municipal regulatory mandate in areas related to climate change, which in turn is determined by national law and regulation. Depending on the political system, states, prefectures, and provinces may have considerable autonomy in establishing climate change targets, renewable energy and energy efficiency strategies, transportation planning, and regional development schemes or regulations in the relevant areas. Even with a strong mandate, however, identifying public financing to leverage private investment locally may ultimately constrain or enable effective action.

A key issue for the implementation of local climate policies and actions is also related to the institutionalisation of such policies and strategies within local administration and their integration with other sectoral plans.

Cities have created a range of institutional mechanisms to implement climate-related policies. The City of Zurich, for instance, created a special unit for environmental protection in charge of supervising the city's climate policy with cross-departmental tasks within the city administration. This special administrative unit is responsible for assessing every planned development and construction project in terms of its impacts and the departments responsible for the implementation of such developments need to account for the results of this assessment.[23] Other responses to integrating climate change in urban governance include the creation of a unit in charge of climate change policy within each climate-relevant department, a climate-policy steering group[24], a climate protection co-ordination group, or an over-arching unit with appropriate competences for mainstreaming climate change policy. In San Francisco, the Office of Climate Protection Initiatives is funded to co-ordinate the multiple climate initiatives undertaken by several programmes, lobby for climate protection legislation at the federal level, and for example, work with local private companies to encourage the use of vehicles that run on biodiesel. Progress made so far has been significant: the city has a 70% recycling and composting rate, the strongest green building standards for new buildings in the United States, and the largest local financial rebate for solar installations.[25]

[23] To guarantee that this model works properly requires, first, strategic plans comprising sectoral targets, policies and measures (such as the combination of a general master plan for the environment and a specific master plan for energy in the city of Zurich); and, second, a project-based approach which prevents departmental segregation.

[24] California is moving toward the idea of cross-institutional networks. This is being done, in part, through the Climate Action Team that is charged with coordinating action among different departments, actors, and interests (Rabe, 2009; Corfee-Morlot, 2009). The Climate Action Team is composed of members of the California Environmental Protection Agency (CalEPA), the Business, Transportation and Housing Agency, the Department of Food and Agriculture, the Resources Agency, the Air Resources Board, the Energy Commission, and the Public Utilities Commission. The Secretary of the CalEPA heads up the team. The Climate Action Team is required to report on their progress towards meeting the statewide greenhouse gas targets.

[25] San Francisco also has a bus fleet that runs entirely on electricity or biofuels; a taxicab fleet 80% of whose vehicles will be green by 2012; and among the highest levels of bicycle commuting in the United States. These programs, plus the attempt to purchase clean and green energy for the city's electricity grid, has resulted in an independently verified 6% reduction of greenhouse gas emissions below 1990 levels.

However, most cities do not pursue such a systematic and structured approach and, instead, prefer to concentrate competencies for climate change policy in an environment department or agency. Traditionally environmental departments have been weaker politically and in terms of resources than other departments in sub-national administrations. For example, this is the case in approximately two thirds of German cities (Kern *et al.*, 2005). This may lead to coordination and integration problems if the environmental agencies do not have the power nor necessarily the competence to implement comprehensive or sectoral policy. For example, in Johannesburg a process of semi-privatisation has occurred within the local authority which created a silo effect, where communication between different agencies, utilities and the city administration are fragmented (Holgate, 2007). Although climate change policy is an issue area that affects a variety of sector or line departments within the local administration (such as administrative units dealing with finances, procurement, urban planning, economic development and education), in many cities expertise on these questions is still concentrated in the environmental department. In other words, in the majority of cases, climate-related issues are not taken into account when climate-relevant decisions are taken outside the environmental department.

Table 4. Modes of governing and local climate change policy (Mitigation)

Self-governing	Governing by Authority	Governing by Provision	Governing through enabling
Energy			
- Energy efficiency schemes within municipal buildings (such as schools) - Use of CHP within municipal buildings - Purchasing green energy - Procurement of energy-efficient appliances - Eco-house demonstration projects - Renewable energy demonstration projects (Internal) contracting (Germany)	- Strategic planning to enhance energy conservation - Supplementary planning guidance on energy efficiency design - Supplementary planning guidance on CHP installations or renewable - Supplementary (private) contracts to guarantee connection to CHP or renewable energy installations (Germany)	- Energy efficiency measures in council housing - Energy Service Provider (Stadtwerke) (Germany) - Energy Service Companies (UK) - Community energy projects (UK)	- Campaigns for energy efficiency - Provision of advice on energy efficiency to businesses and citizens - Provision of grants for energy efficiency measures - Promote the use of renewable energy - Loan schemes for PV technology HECA report (UK)
Transport			
- Green travel plans - Mobility management for employees - Green fleets	- Reducing the need to travel through planning policies - Pedestrianisation - Provision of infrastructure for alternative forms transport - Workplace levies and road-user charging (UK)	- Public Transport Service Provider (Verkehrsbetriebe) (Germany)	- Education campaigns on alternatives - Green Travel Plans - Safer Routes to School - Walking Buses - Quality partnerships with public transport providers
Planning			
- High energy efficiency standards in new buildings - Use of CHP and renewables in new council buildings - Demonstration projects—house or neighbourhood scale.	- Strategic planning to enhance energy conservation - Supplementary planning guidance on energy efficiency design - Supplementary planning guidance on CHP installations or renewables - Supplementary (private) contracts to guarantee connection to CHP or renewable energy installations (Germany)		- Guidance for architects and developers on energy efficiency - Guidance for architects and developers on renewables

Waste			
- Waste prevention, recycling and reuse within the local authority - Procurement of recycled goods	- Provision of sites for recycling, composting and 'waste to energy' facilities - Enable methane combustion from landfill sites	- Recycling, composting, reuse schemes - Service provider (Stadtwerke) (Germany)	- Campaigns for reducing, reusing, recycling waste - Promote use of recycled products

Source: Bukeley & Kern, (2006).

Implementation obstacles

The analysis of existing local climate change plans shows an important implementation deficit. A reality of many early greenhouse gas emission targets established at the local levels is that they were not met. Most local and regional plans have been established with insufficient attention to which policies and measures would be necessary and how to assure implementation of policies once introduced. Very few jurisdictions have issued progress reports or evaluations. Several reasons are being advanced for this implementation deficit.

Institutional blockage within local administrations: In the U.S., many individual states have established ambitious plans, but implementation has proven problematic. Barry Rabe (2009) notes that in New Jersey, implementation of the 2000 Sustainability Greenhouse Gas Action Plan was hampered by lack of a governing structure that could co-ordinate, monitor, and control the actions of so many different departments and agencies involved in climate mitigation activities. Different departments have different interests and priorities.

Insufficient capacity and expertise. The lack of technical expertise in planning authorities to deal with climate change-related issues has been recognised as a main obstacle, particularly in cities in emerging economies like Johannesburg (Holgate, 2007) and Mexico City (Molina 2007) as well as more advanced cities like London (Bulkeley and Schroeder 2008).

Lack of appropriate funding. A key obstacle to implementation stems from the realty that most existing plans do not mention specific needs for funding and many local governments do not have the capacity to include funding requirements into their climate change programme. The lack of appropriate funding also explains why certain cities do not integrate a major sector in their action plan. The City of Los Angeles climate plan, for instance, largely ignores the costly transport sector, although it is responsible for around half of emissions in the city. Due to differences in financing structures, some local governments shoulder greater financial burden than others to fund climate change plans. While U.S. cities such as Portland, Seattle, Denver and Chicago can share the financial burden of expanding the public transport system with the state government, local governments in California must generate 90% of funding for transport infrastructure from their local revenues (Bulkeley and Schroder 2008).

Lack of devolved authority or appropriate responsibility. In many OECD countries, local authorities can lack sufficient jurisdiction over matters that greatly affect their greenhouse gas emissions. These include energy policies (particularly national electrical grid development and maintenance), funding for transportation development, maintenance and operations, taxation and revenue generation authority. Some competencies might not be under the responsibility of the right scale of intervention. For instance, waste management in London is under the responsibility of local borough councils which prevents the Greater London Authority, which covers an area closest to the functional area, to use waste in the provision of energy. On the other hand, while decentralisation is often advocated as the solution to reinforce implementation capacity, it has some cases led to a paradox when more responsibilities are delegated to local authorities, while they lack financial resources and even the decision-making power to undertake effective policies. This being said, the experience in many countries suggest that municipalities do not fully

exploit their authoritative powers and are reluctant to apply authoritative modes of governing through regulative measures and strategic planning (Kern in OECD, 2009).

Within metro-regions, an issue for coordination might arise with sub-local units when they are responsible for important climate-related issues. To again draw from the experience of Greater London, the City of London has faced difficulties in establishing relationships with the 33 local or borough councils that are contained in the Greater London area. Only 23 have signed the national Nottingham declaration for local councils and only six have a climate change action plan. With the exception of providing directions to local level planning and through the development of public transport, there are few direct means through which the Mayor, the GLA and the LDA can affect action a local level. Local councils are driven by their responsibilities in relation to performance indicators and local agreements are signed directly with the central government and in which climate change play a minor role. Even in relation to planning, the Mayor's powers are limited to providing direction for Local Development Frameworks which must be in general in conformity with the London Plan. This issue is particularly acute for waste management, which is under the responsibility of local councils (Bulkeley and Schroeder, 2008b).

Lack of support from central governments. This also often impairs the effectiveness of sub national climate change policies. The actual response of local governments varies considerably due to national programmes, legislative, regulatory and policy frameworks which support local initiatives. The existence of national policy and measures with respect to planning (*e.g.* improving the energy efficiency standards of new buildings) and business (*e.g.* carbon reduction commitment) are important to provide drivers for action among actors. The absence of appropriate regulation in key areas, particularly with regard to energy generation and supply, is perceived as a major obstacle. In its climate change action plan issued in 2007, London admits than it can only achieve half of its ambitious goal of a reduction in CO2 by 60% by 2025 without the central government (GLA 2007).

(4) Policy evaluation

Relatively few evaluation frameworks have been employed to measure the outcomes of climate policy at local scale. This may be due to the fact that the most aggressive policies, have only been recently launched. One exception may be found in Newcastle, Australia, funds which has created the world's first and only device, known as a greenhouse gas "speedometer" and accessible online at climatecam.com, that monitors and reports the city's consumption of electricity, gas, liquid fuels, waste to landfill, water consumed, trees planted and the resultant equivalent in tonnes of carbon dioxide expended. The electronic billboard includes a 500-megawatt electricity meter in the town square, updated hourly from data sourced directly from the energy providers in the 15 electrical zone substations that power the city. The device has demonstrated that if the city had continued business as usual, it would have increased its greenhouse gas emissions by 2008 to around 20% to 35% above its 2000 level. In addition, the 250 council-owned and operated facilities that fuel the city have managed to reduce electricity consumption by 40% compared with 1995 levels, and water consumption by 25%, thanks to an action-based research programme and the establishment of a rating system. In the absence of large-scale national funding, the city has entered into a public-private partnership with 12 foundations (Together Today PPP). This has proved essential for bringing together those who need low-carbon products and services and those who supply them.

With respect to mitigation, it is common to observe cities in the OECD that rely on the development of aspirational goals as the indicators of progress rather than the development and attainment of actionable mitigation and adaption targets that are quantifiable and verifiable (Wheeler 2008, Medearis 2008). This is reflected in the litany of cities which have adopted climate change mitigation goals but are unable to fulfil their targets, or develop meaningful performance measures linking energy management and emissions reductions. The landscape is full of sub-national governments unable to tie quantifiable mitigation targets with large-scale applications of energy efficient buildings, building retrofits, renewable energies, and transit-oriented development.

With respect to adaptation, analyses of impacts and adaptation options at a city-scale level, and relevant decision making, is at a very early stage. Within the last decade, a number of OECD country cities have undertaken multi-sectoral analysis of potential climate change impacts, including London, New York, Boston, Hamilton and Wellington (Hunt and Watkiss 2007). There are very few detailed studies and these studies are largely qualitative in nature. One exception is the cost-effectiveness analysis in a study undertaken in Boston. Further work is needed to advance understanding of the costs and benefits of adaptation options at local scale.

A main obstacle to policy evaluation is linked with the difficulties in developing performance benchmarks and creating a monitoring system to assess policy performance. As will be developed in the next section, at the level of aggregate GHG emission performance at urban scale, standardised greenhouse gas emission inventory and standard reporting protocols for cities would also help cities to achieve their goals, to measure the progress and compare the cost-effectiveness of actions at sector level and to become potential actors in the carbon market which could open the way for new sources of funding for city-scale mitigation efforts.

Collaboration between municipalities and regional government

Inter-municipal action to combat climate change

A lack of horizontal collaboration among municipalities within urban regions can also be an obstacle to actions to combat and adapt to climate change. In many cases, the administrative structure of governance does not fall precisely within metro regions' actual boundaries, so that carbon-relevant functions, defined economic interchanges, flows of materials and energy, and transportation between activities and households in the city's core area and localities overlap across multiple jurisdictions. This requires that city officials engage in the sometimes challenging task of co-operation with other local governments.

Inter-municipal cooperation within metropolitan areas has been identified as a key obstacle for well-functioning and competitive metro-regions (OECD, 2006). The series of OECD metropolitan reviews pinpoints in particular how the integration of spatial and transport planning creates institutional structures capable of ensuring urban sustainability. The coordination of transport offers particular potential given that between 30 and 40% of total CO_2 emissions in cities in the ITF/OECD area are generated in the transport sector (Crass in OECD, 2009). The European Commission's Green Paper on Urban Transport as well as the International Transport Forum highlight how improvements in inter-municipal collaboration can help tackle congestion, air pollution, health problems, noise, and greenhouse gas emissions.

Ultimately, metropolitan areas endowed with an existing inter-municipal collaborative framework or appropriate administrative unit level at this scale would be better positioned to deal with the issue of institutional fit in the field of climate change. The underutilised inter-municipal coordination tools within metropolitan areas may pose serious problems for adaptation policies, which typically need to be decided and implemented at a regional scale (*e.g.* for example water management systems and precautionary flood-protection measures along rivers).

Successful mitigation policies also often depend on technical infrastructure, which transcends city borders *e.g.* power distribution and transmission infrastructure. The lack of institutional fit with carbon-related issues has been identified as a key issue for an effective implementation climate change strategy in Mexico City. Although a few examples exist of climate change action plans at the metropolitan level, most notably in London, Hanover, and Portland, collaborative inter-urban frameworks for climate change policies and strategies are the exception, not the rule.

Box 4. Cases of Metropolitan Coordination for Climate Change Action Planning

London: In London, the creation of the Greater London Authority in 2000 with a direct elected assembly and mayor provided the opportunity to address climate change at the London-wide scale. Planning responsibility allows the Mayor to promote the use of on-site renewable energy generation (micro-generation) and Combined Heat and Power (CHP). In the first term of the mayoral mandate, the Greater London authority formed formation the London Energy Partnership. This was followed by the introduction of the congestion charge and the approval of policies for addressing the emissions of new development. This momentum led to the development of a Climate Change Action Plan and the creation of the London Climate Agency in 2005 to deliver the policy framework (Bulkeley and Schoroeder, 2008b).

Hanover: The German metropolitan region of Hanover, a metro-region with about four million inhabitants, benefits from a regional approach to mitigation and adaptation strategies. The Regional Climate Protection Agency (Klimaschutz-Agentur Region Hannover) co-ordinates all climate protection activities throughout the region. In the meantime, the regional association of local governments and Hanover county have been transformed into a new authority covering the metro-region, *i.e.* 'Hanover Region' (Region Hannover), and major competences have been transferred to this body.

Portland: Metro Portland (Oregon), which serves the city of Portland, three counties and 25 cities in the region, is in charge of maintaining the Portland area urban growth boundary and is also responsible for the region's transportation system. This is crucial to avoid urban sprawl and is, therefore, a key element of the regional mitigation efforts. The city of Portland was the first city in the USA to put a local climate action in place. In 2001 Multnomah County followed Oregon's lead and developed a regional strategy (Local Action Plan on Global Warming) covering the city and the county. This strategy includes 150 short and long term measures with the overall goal of reducing CO2 emissions by ten percent by 2010 (Ekelund/Sigurdson 2008: 25). Portland, like Hanover, is governed by an elected regional body, which facilitates may explain the strength of its regional collaboration (OECD 2006, Competitive Cities).

Beyond inter-municipal cooperation in one geographic area, some local governments have implemented resource-pooling strategies that have achieved significant savings through co-ordinated action, such as projects to purchase energy-efficient products for common use. For example, the Clinton Foundation has helped organise a "Purchasing Alliance" of green cities that collectively negotiates discounted pricing agreements for a range of energy-efficient products. The Clinton Foundation, along with ICLEI and other groups have also created similar networks for cities to pool know-how to reduce policy development costs and create uniform environmental monitoring frameworks. In Europe, regional energy agencies, which are partially funded by the EU offer guidance and services on energy and transport policy to some 260 local and regional agencies. However, in most cases decision making remains the prerogative of local governments and the influence of these international or transnational networks is limited, in particular if their funding is not ensured in the mid and longer term.

Regional strategies and actions

Regional approaches to climate change mitigation and adaptation can provide a scaling-factor that can make structural changes possible that would be unattainable on a purely local basis. At the regional level, greater technical and financial capacity, and environmental know-how may exist than within individual cities or towns. Regions can also develop strategies that can link policies and programmes that would otherwise operate in isolation (*e.g.* connecting initiatives in urban and rural areas). By achieving levels of scale not possible at the local level, regional strategies have the potential to make larger changes to greenhouse gas emissions reductions. Thus, whereas an individual city might be able to think ways to improve energy efficiency in housing within existing structures, at the regional level it may be possible to consider urban planning strategies that will result in not only more efficient housing designs and standards, but also where houses are built and their relationship to the regional environment.

Many examples of regional climate and energy initiatives provide insight into cross-cutting climate solutions. For example, various communities in and around the industrial region of Eindhoven, the Netherlands came together to build upon their regional strengths in technological research and development in an effort to meet three interlinked goals: a cleaner environment, preserving jobs, and building a technology for the future (Broaddus, 2007). The Samenwerkingsverband Region of Eindhoven was at the centre of the development of the low-emission public transport vehicle, the Philias—an advanced, guided bus that is controlled by a magnetic system built into the road—and that connects various communities within and around Eindhoven to major regional facilities, including the airport.[26] The San Francisco Metropolitan Transport Commission offers an equally powerful example of action at larger regional action to enact the infrastructural and technological changes necessary to "green" transportation structures, improve connections within and between urban areas, and limit emissions from transport through the introduction of low emission and alternative fuel vehicles. This kind of larger structural transformation requires substantial coordination among land use planners, technical specialists, engineers, conservation experts, and administrators at the local, regional, and in some cases, the national level (Box 5).

Box 5. Transportation 2035 Plan for the San Francisco Bay Area

San Francisco Bay's Metropolitan Transport Commission issued the draft "Transportation 2035 Plan: Change in Motion" in December 2008 for public review and comment. The plan is built on the 3-E principles of economy, environment, and equity. It was two years in the making and was based on wide-spread public input that was obtained through a regional forum, workshops, telephone surveys, on-the-street surveys, focus groups (including in low-income areas), consultations with tribal, federal, and state resource agencies.

Given that transport related emissions account for 50 percent of the Bay's greenhouse gas emissions and future population growth, the plan sets out the goal of reducing transportation-related emissions by 40 percent below 1990 levels by 2035, cutting congestion by 20 percent, reducing daily vehicle miles travelled per person to 10 percent below 2006 levels, and reducing by 10 percent the share of low-income residents' household earnings consumed by transportation and housing. Proposed ways of achieving this goal include smart growth policies, reduced congestion through improved and more effective infrastructure (freeway ramp metering, changeable freeway message signs, coordination of traffic signals along adjacent arterials, carpool lanes), expanded transit service, bike lanes, high speed rail, high occupancy toll lanes, express bus service, a carbon or vehicle-miles travelled tax, incentives to channel new housing and jobs into existing communities and the urban core.

Source: Metropolitan Transportation Commission, "Transportation 2035 Plan for the San Francisco Bay Area," Draft. December 2008

Summary points

From the examples examined here, it appears that those cities with forward-looking policies may stand to gain economically from action on climate change. A (hypothesised) counterpoint might be that those that lag in action may face greater costs and a loss in competitiveness from an eventual transition to a low carbon economy, as local businesses would not necessarily be well-positioned to exploit emerging opportunities. Given the greater ability to experiment with new approaches at smaller scale, the opportunity for social or technological breakthroughs to occur at local level is also higher. For example, the successful rent-a-bicycle programme in Paris ("Vélib'") or the rapid transit bus system in Mexico city have demonstrated the ability to shift the way people use transportation and lower urban GHG emissions; these programmes provide a base of experience on which to build broader diffusion elsewhere. Thus local innovation can be a means to test and eventually demonstrate ways to shift not only technology and investment but also consumer behaviour and lifestyle patterns towards climate friendly outcomes.

[26] Philias Bus Rapid Transport Eindhoven, Part I, Video. www.youtube.com/watch?v=StN-4xdzhz4.

While a number of municipalities, often with access to substantial human and financial capital, have moved forward in addressing climate change, it seems that an overwhelming majority have not. A number of authors have warned against a situation where an 'island of 'best practice' is surrounded by a sea of 'business-as-usual,' and thus serve as a 'lightening rod' to distract attention from a passive national policy." (Aall *et al.* 2007:99). The establishment of policy frameworks at the national and international level to enable cities to act will be a key factor in aiding the majority of cities in moving beyond business-as-usual practices.

4. LOCAL-NATIONAL CLIMATE POLICY LINKAGES

Main rationale for local-national policy linkages

These are several broad reasons for national governments to better engage with local governments and stakeholders on the issue of climate change. First local authorities serve as a vehicle for the implementation of nationally driven policies, to ensure that the mandates outlined at national scale are actually carried out and deliver meaningful results at local scale. Second, through local policy and urban planning reforms, local governments may be able to build resilience to climate change into urban infrastructure and development patterns. Third, urban scale action may be important in its own right and able to provide a means of social and technical innovation that is not possible at broader scale, ultimately providing a vehicle for learning and broader dissemination where successful innovations occur. In this way, experimentation and learning at the local level can provide essential experience and, when successful, lead to bottom-up diffusion of approaches between cities and regions as well as to influence national and even international levels of actions (Corfee-Morlot, 2009; Bulkeley and Betsill, 2005).

In adaptation, local level decision-making is important for at least three reasons. First, climate change impacts are manifested locally, affecting local livelihood activities, economic enterprises, human health, etc. Second, vulnerability and adaptive capacity are determined by local conditions. Regional or national vulnerability indices often mask the dramatic variations in vulnerability at local levels. Third, adaptation activities are often best observed and implemented at the local level. Decisions about livelihood strategies and investments drive adaptation. Local monitoring and evaluation of how policies, programmes and projects are supporting adaptation are essential as they also provide a basis for learning, adjusting and eventually scaling up actions that are successful (OECD, 2009).

Local action will also provide essential insights for understanding the political economy of climate change policy. It will provide a vehicle to identify how incentives and interests interact at different levels of governance, to observe and understand direct local costs and benefits of action, including local co-benefits, and the local winners and losers of any particular set of policy choices. The evidence or perceptions of who wins and who loses, and the weight of co-benefits associated with any set of climate policies may significantly differ at local scales compared to aggregate nation-wide experience. This can open a range of opportunities for local action that may not exist at broader scales.

Thus it is in the best interest of national governments to focus on how they can better empower and enable local governments and stakeholders to address climate change through everything from day to day decisions to broad urban planning decisions with long-term implications for the future. This will assist them to learn in parallel with local communities about the range of policy options at hand and their performance in different local contexts, thus providing an essential testing ground for policy.

Beyond understanding of costs and benefits of action, Table 5 highlights three different clusters of drivers that shape approaches to climate policy at different scales of action:

i. government functions and roles

ii. key actors and institutions

iii. tools for decision making

How each of these different clusters join up to work together across scale will determine the boundaries for decision making and alter the outcomes at any particular level.

With respect to the first cluster - government functions, responsibilities and roles – there is significant variation across scale and different opportunities and challenges at each level. For example, local governments have some autonomy over urban planning and land use decisions or on public transport priorities, but they may not have any of the responsibility for provision of key transport infrastructure such as roads. The division of authority in key areas such as infrastructure (roads, parking, public transport systems, and buildings) or even service provision (water, energy, waste management) will define the potential for local governments to act. The "nested" institutional structures of government decision making on issues central to climate change, underscores the need for linked up policy frameworks that address climate change across levels of government.

On the second cluster, institutions and actors at each level of government are important as they largely determine both the resources available to support climate decisions and the politics of decision making. At a national scale, national governments (both the legislative or parliamentary and administrative branches) are responsible for large public budgets to support public action, whereas public resources are typically much more constrained at local scale. As such, there is much greater flexibility at national scale to shift significant resources to finance new policy initiatives such as climate change. Other types of human or expert resources may also be more readily available at national or regional scale than at local scales to support climate decision making, for example through public university systems or national research institutes. Even if the resources are made available to support local decision making, the challenge will be to build a local knowledge base that informs decision making. In many cases, obstacles can derive either from the lack of devolved responsibility or excessive decentralisation without commensurate financial tools and/or lack of appropriate capacity at the sub-national scale.

A look across the diversity of actors playing into climate decision making at different scales suggests that the politics of climate change may be more tractable at the local scale. This is because there will necessarily be a narrower set of local interests than at broader levels of decision making. At national levels, policymakers are faced with trying to ease the transition for all business sectors in the nation that are set to lose due to climate policy, while at local levels in many instances there will be a narrower subset of these interests to deal with and interests may more easily align to experiment with pro-environmental stance. This provides some opportunities for stronger or at least more experimental pro-environmental action at local levels than at national levels of decision making.

Table 5. Climate change and multilevel governance: key actors, functions and tools at different scales of action

	Local/city	**Sub-national regions (*e.g.* states or provinces)**	**National**	**International**
Government functions and roles	Implement local decisions as foreseen under national or regional law Where authority exists – act autonomously *e.g.* through land use planning, decisions on local infrastructure (*e.g.* local roads, urban planning and zoning, flood control, water supply, local parks/reserves/green-spaces, sanitary waste) Identify local priorities – enhance local/regional understanding working with local actors Raise awareness, create deliberative "space" for decision making Develop locally adapted policies and measures *e.g.* public private partnerships and local public procurement policies	Implementation of national laws, standards Regional climate policy framework – near and long-term targets – regional strategic orientation Regional laws and policies in key climate-related sectors (*e.g.* energy, air pollution, water). Regulate performance in key sectors where permitted by national law to do so (*e.g.* building or appliance standards) Prioritise and set out time frames for regional action (*e.g.* by sector) Provide incentives, funding and authorisation to enable local action on climate change Risk characterisation at regional scale; definition of risk management rules or guidance, funding, and principles. Establish a monitoring system to track GHG emissions and policy performance over time Fund core analytic inputs to facilitate regional and local decision making Ensure that decision-makers have the tools, information and appropriate institutional context to deliver good decisions	National climate policy framework – near and long-term targets – strategic orientation for policy National laws, policies & standards in key climate-related sectors (*e.g.* energy, air pollution, water). Regulate performance (*e.g.* building or appliance standards) Prioritise and set out time frames for national action (*e.g.* by sector) Infrastructure funding and authorisation for construction (*e.g.* national roads, sitting power or transmission facilities, water supply and quality, parks or reserves) Establish a national inventory system and build understanding of nation-wide mitigation opportunities and their costs Risk characterisation at national scale; definition of risk management rules or guidance, funding, and principles. Monitor performance of climate policies – national scale Fund core analytic inputs to facilitate sub-national (regional and local) decision making Provide regions, local governments with tools and support to make good decisions (*e.g.* inventory methods)	Set out timeframe and priorities for cooperative action, collaborative framework to guide national action Provide seed resource to support action Monitor and peer-review and where appropriate, compliance assessment (*e.g.* FCCC) Facilitate sharing of experience between nations

	Local/city	**Sub-national regions (e.g. states or provinces)**	**National**	**International**
Key Institutions or Actors	Public: city, county or other public authorities Private sector: local industry and business, tourists, households Local environmental or consumer organizations Local and regional experts	Public: state or provincial governmental authorities Semi-autonomous public or public-private institutions (*e.g.* school boards or issue-based commissions) Private sector: regional industrial federations; major corporations Environmental organisations Academic networks, universities Worker unions	Public: national governmental authorities Semi-autonomous public or public-private institutions (*e.g.* school boards or issue-based commissions such as for water or air pollution management) Private sector: national industrial federations; major corporations Environmental organisations Academic networks, universities Worker unions	Public intergovernmental organisations and institutions (*e.g.* MEAs) Private: multinational companies, *e.g.* insurance, energy, telecommunications. Major environmental and development non-governmental organisations (*e.g.* WWF, Greenpeace, WRI, Red Cross, etc)
Tools for decision making	Deliberative or participatory policy processes (perhaps linked to ongoing policy processes *e.g.* urban planning and infrastructure decisions) Local GHG inventories – standardised and linked with national inventory methods Urban vulnerability mapping or risk assessment (*e.g.* flood risk and key infrastructure)	Funding for research Regional climate modelling – building on national research Impact science – regional centres of expertise Policy research – regionally tailored Harness academic resources and facilitate networks Regional GHG inventories Project funding structures to support regional and urban scale action	Funding for research Climate modelling – national research (*e.g.* NOAA, UK Hadley Centre) Support for impact science – regional (sub-national) centres of expertise Policy research – including support for regionally tailored research Harness academic resources and networks National GHG inventories Project funding structures to support urban scale action	Funding for research International research collaboration and science-policy networks (*e.g.* IPCC) Harmonised GHG inventory methods Harmonised reporting systems (*e.g.* FCCC) to provide oversight for international carbon markets

Another institutional issue is the ability for strategic policy development at any one level to incite climate-friendly investment and behaviour. At national level an important factor is how national governments handle design and implementation of climate change policies. For example the diffusion of responsibility in one or several departments will matter given that line ministries that address sectoral issues have multilevel governance practice built into their mandates. There is also a need for focused attention to building capacity throughout levels of government to undertake pro-active assessment of the costs and effectiveness of policy options in the areas of mitigation and adaptation. This will take some training but also access to standardised tools and up to date information in each area. Within this, national governments will need to take some responsibility for decentralising understanding and building ownership and responsibility throughout government as well as across stakeholder communities. This task will be facilitated by the creation of economic and financial incentive mechanisms that serve to make the costs and the risks of climate change apparent in day to day market transactions. Where markets are not present or well-functioning, there is a need for different types of instruments, perhaps in the form of direct public financing to alter outcomes.

Finally on the third cluster, tools for decision making may also vary across levels of decision making (see also Section 4). At the international level, for example, governments have worked collaboratively to design and implement markets for emission reductions. This rests upon the use of harmonised carbon market instruments (*e.g.* typically national emission trading programmes in OECD countries) and greenhouse gas reporting instruments (*i.e.* standardised inventories and registry tools). At national level on mitigation, such instruments are used to guide private sector investment to least-cost outcomes. Additionally, it can be argued that a key tool is centralised (national or regional) support programmes aiming to finance local action on climate change. Similarly at the local scale, key tools include also internationally harmonised accounting or inventories of GHG as well as the use of open, consultative practices to generate ideas and support for local action.

Institutional models: local-national cooperation on climate change

A review of practice across a range of OECD and emerging economy (Brazil, China, South Africa) locations reveals that there are various types of institutional models influencing or guiding policy action on climate change across levels of government. These include: i) nationally or regionally led enabling frameworks with predominant influence moving through national policy to influence local action; ii) bottom-up or more autonomous local or regional action that in turn may influence national action; iii) a hybrid approach showing features of both and sometimes encompassing strong public-private interactions. Each of these is discussed in turn below.

Table 5 provides an overview of a number of examples that demonstrate these different models and types of influences. Many of these are highlighted below; more detail on these examples can be found in Annex 1.

Nationally led -- "top-down" enabling frameworks

A main institutional approach to incentivise local action that is observed in many countries is a centralised enabling framework. Such a framework uses national policy to require that local and/or regional authorities to take climate change into account at local level. In this model, central governments can develop a variety of different policies that can serve to assist local governments to contextualise national (or regional) policies and priorities as well as assist local governments to develop the competencies necessary for municipalities to take further action on their own. Developing policy frameworks to support local-level action is just as important in countries where national governments have made a strong commitment to climate action as in those that have not, as local governments have an important implementation role to play if national emission reduction and adaptation targets and goals are to

be met. A first order issue for national governments is to understand exactly how best to clarify goals in local contexts and to work with local governments on implementation. Beyond the essential role in implementation, there is a need to document experience and progress at local level, not least to understand at national scale and further within the context of international obligations, to what extent progress is being made to mitigate and adapt to climate change.

As noted in the Section 3, four different modes of governing climate change pertain at local levels: self-governing municipal operations (*e.g.* municipal buildings or vehicle fleets); provisioning (in terms of public services *e.g.* in the water, waste or energy area); regulating; and enabling. Local governments also face a number of implementation barriers in their efforts to advance climate change response. For example, in both mitigation and adaptation policy areas, city authorities often find their ability to act constrained as emissions sources or different aspects of land-use planning fall outside of their jurisdiction. In these cases national approaches and regulations are essential to spark action, giving a mandate or at least a framework within which cities can act.

At a minimum, national policies will be essential to establish broad, cross-sectoral price signals to guide investment to climate-friendly outcomes, for example through a tax on carbon or establishment of national cap and trade regulations. More targeted, sector specific national regulations may also be needed, for example, to encourage large-scale measures in energy conservation and fuel switching (Betsill 2001:403). Additionally, national policies can also help to ensure that climate policy within countries is not confined to a few front-runner municipalities, but is rather integrated into the functioning of urban areas across the country (Aall *et al.* 2007:99). Centralised frameworks therefore can ensure that a few 'best practice' examples do not distract attention from the importance of pushing the majority 'business as usual' municipalities into taking action (Aall *et al.* 2007:99).

In a similar manner, national policies targeting local authorities may also take different forms, ranging from regulation or requirement that local authorities take certain actions to enabling. However many of the examples examined relate to enabling policies or frameworks where mandated approaches play a role but the general framework is one that leaves wide latitude to local authorities to taper local policies on climate change to local contexts.

One of the earliest examples of a national enabling policy framework on climate change at urban scales can be found in **Norway**. In June 1998, the Norwegian parliament passed the Government White Paper on the Kyoto Protocol, introducing local climate policy as an explicit policy area. Using the White Paper as a base, the Minister of the Environment issued a circular in September of the same year requesting municipalities to develop local climate plans aiming at reducing carbon emissions and increasing sequestration through forestry projects. These plans were to be developed in partnership with the country and regional government authorities. To support the development of these plans, a local climate policy program was established in 2000 by the Ministry of the Environment to allocated NOK 7 million (1 million USD) to stimulate action. With these funds, 26 projects were supported involving 37 of 435 municipalities and 8 out of 19 counties. In addition to financial help, a web-based information source and emissions calculation tool was put in place by the national government (Aall *et al.* 2007). In the development of climate plans, national financial support appears to have been a key catalyst as only one municipality was reported to have taken action without grant support. However, while plans have been established, it appears that implementation has stalled as funding has not been available to municipalities to support the implementation of the programs (Aall *et al.* 2007).

In China, the central government's National Climate Change Policy Coordinating Committee is an inter-ministerial committee that is responsible for policies addressing climate change. However the division of labour between national and local levels of the organization is difficult to establish. Moreover, laws are formulated in a way to let local administrations interpret them to their own advantage. China's

central government is aware of the need for regional governance in climate change and has recently signed contracts on energy efficiency and pollution reduction targets with provincial level officials and is currently looking for a new approach in the energy sector (Yuan 2007). The central government's new preoccupation with environmental issues, combined with the annual performance review of the local leaders, may provide a means for the central government to put additional pressure on local and regional governments to achieve local emission reductions and increase energy efficiency. The central government is now looking at voluntary agreements as a substitute for top-down, nationally led policies (Yuan 2007).

A number of other countries have also established national programs to assist local level governments in the development and implementation of climate policies. For example, in **France**, the Agence de l'Environnement et de la Maîtrise de l'Energie, an inter-ministerial agency focused on environment and energy research and policy, has developed a funding program to assist municipal areas with the development of a Bilan Carbone emissions inventory. The ADEME provides expert input as well as financial support, being able to cover in certain cases up to 50% of the cost of emission inventory development.

In the **Portugal** and the **United Kingdom**, a number of central policies and programs have been established to assist local governments. In the United Kingdom, these include the use of Regional Development Agencies to foster regional approaches (see below), as well as the Carbon Trust and Energy Savings Trust, which are also helping to pilot energy savings programmes across England's core cities to develop management plans. On the issue of adaptation, the UK Climate Impacts Programme is active to generate local and regional knowledge about climate change and to build capacity at this scale to enable timely and cost-effective adaptation. In Portugal, the project "Climate Change in Portugal: Scenarios, Impacts and Adaptation Measures" (SIAM) brings together scientists from various disciplines to advance research on climate change and disseminate knowledge. Several local communities have started to take action. As an example of good practice, Sintra (nearby Lisbon), is the first Portuguese municipality with a strategy of adaptation to climate change, designed in collaboration with the SIAM team (see Annex A).

Learning from the "bottom up" -- from cities and regions to national action

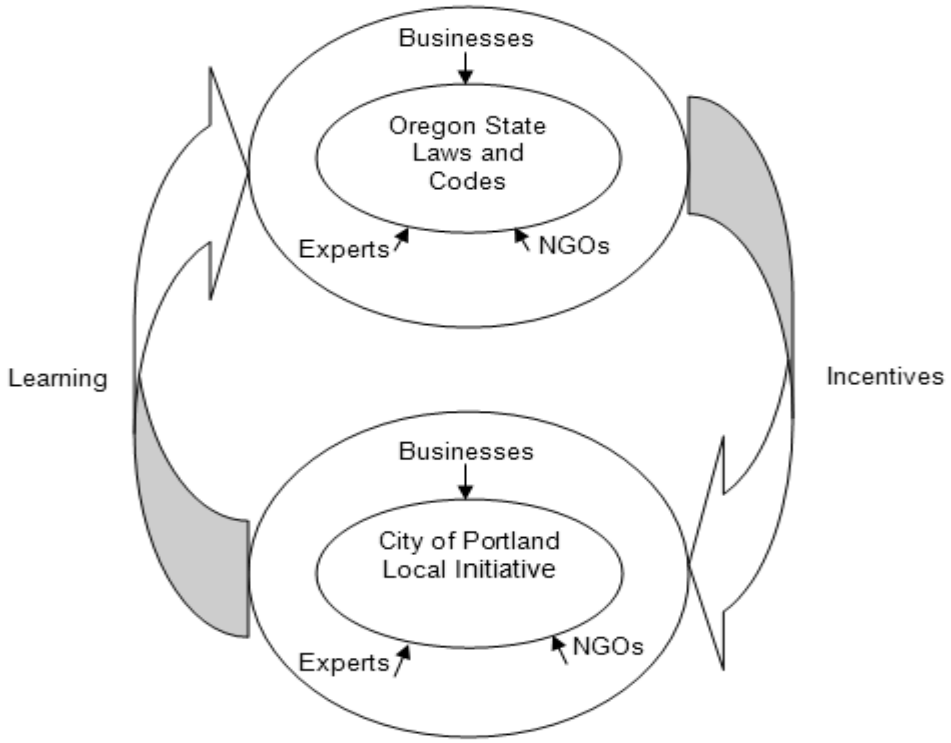
A second model is "bottom-up" where regional or local authorities are encouraged or allowed to go beyond national requirements or incentives to independently act to address climate change, either as an active part of national policy or in the or in the absence of national policy. In this model, learning and experience acquired through successful local programmes diffuses to inform and steer policymaking at regional or national levels of government. Inevitably both directions of influence – top-down and bottom-up – co-exist to shape action and policy across levels of decision making.

Experience from the **City of Portland** and the **State of Oregon** in the **US** demonstrate this type of example. In this case Portland's efforts, dating back to 1994, to aggressively develop a green building sector and innovation has had a direct influence on state-wide policy. Interestingly, the effort was begun by a volunteer citizen group, which was created to inform city council decisions concerning sustainable development and commissioned a planning process to explore the potential for a local green building technical assistance program (City of Portland Bureau of Planning and Sustainability 2009b). It grew into a Green Building program which is a partnership of development-related city government functions and local organizations. The programme today focuses on policy development, demonstration projects, technical assistance, education and financial incentives (City of Portland Bureau of Planning and Sustainability, 2009b). It is funded through local residential and commercial solid waste fees, and grants. The Portland programme also includes a Green Investment Fund, which is operated in partnership with the Oregon Energy Trust (EDAW 2008).

The local motivation to create the green building programme in Portland is to develop and maintain a local/regional competitiveness around a new green pole of economic activity. In 2007, the City of Portland had the highest number of LEED certified buildings in the United States, and was attracting firms and qualified workers from around the country (Allen, Potiowsky 2008). The Portland experience has provided an important foundation on which to draw insights for broader diffusion through a state-wide effort to regulate building energy performance and move towards green buildings more broadly across the state. The State of Oregon now has a comprehensive web of institutions designed to ensure green building excellence across the state (see Figure 5. and also Annex 1 for more details on this example).

Beyond demonstrating the two-way influence between local and regional policy, this example also shows how participatory local policy processes, with broad stakeholder engagement, can lead to innovative policy and economic change.

Figure 5. Related aims and co-benefits of sector policies to reduce GHGs at urban scale



There are a number of other examples of note in the US as well as in Spain, both of which have a decentralised approach to governance. In turn this allows experimentation and room for innovation for those states and cities with the resources to do so. The State of California is notable for example; its leadership on air pollution control issues has provided a foundation of knowledge, experience and political will to support its recent actions to address climate change – action that is far in advance of those taken by the US national government (Corfee-Morlot, 2009). Also at the local level, New York City has become a leader on the issue of adaptation and mitigation. This is due in part to a strong network of academic and government practioners, working together to advance understanding and support decision making (Hunt and Watkiss 2007; Rosenzweig *et al.,* 2007; see also Annex 1). In Spain, the state government of Catalonia is also active to support cities in its region, notably in the Barcelona metropolitan area, to understand and act upon climate change in the context of sustainable urban development (Laigle, 2009). Other countries with broad decentralisation of climate policy initiatives include Canada (on both mitigation and adaptation at state or regional government level) and Australia (i.e. on adaptation).

Hybrid models

A third hybrid institutional model can also be identified where national and/or regional governments on the one hand, are working closely with local authorities on the other hand, to encourage experimentation and innovation at the local level to respond to climate change, and ultimately to identify successful lessons for broader diffusion elsewhere.

In **Sweden**, responsibility for climate-related risks and physical planning lies with municipalities. The central government, however, has a long tradition of establishing policy directives and mandates for municipalities to align local policies with national objectives (Nykvist and Whitmarsh 2008). Within this system, the municipalities are often provided with substantial financial, legal and professional resources. Stemming from a tradition of centralized support to municipalities to stimulate local environmental initiatives, the Swedish central government developed the KLIMP climate investment program to assist cities in climate change program implementation. Attributed through a competitive process, eligibility for KLIMP grants requires that cities develop a climate strategy including main and intermediate objectives, locally adapted policy measures as well as strategies for follow-up and evaluation. Depending on the projects, funding provided by the central government covers between 25% and 85% of the costs, placing the responsibility for the remainder on the municipalities themselves (SEPA 2004; Kern and Gotelind 2009). Between 2003 and2008, approximately 126 climate investment projects in several cities, representing an investment of 214.9 million Euros over this period, resulting in an estimated 1.1 billion tonnes of CO2 reduction per year (SEPA 2009).27 An initial analysis of these projects in the mitigation areas suggests that focused primarily on energy (52%) with another 25% addressing transportation issues (Storbjork 2007).

The parameters of the KLIMP program have evolved with better understanding of climate change as well as increased emphasis placed on adaptation. The 2007-2008 funding cycle attempts to press municipalities to see climate change in the broader context. As part of this effort, the Värmland region, consisting of 16 municipalities, has created an energy office as common information and support resource which has served as an important partner with smaller municipalities in developing grant applications and programs. While pure educational aspects can be part of submitted projects, applications must include clearly visible and tangible measures and investments (Storbjork 2007).

Finland also has also created a specific institutional mechanism to assist cities and regions to develop capacity, design and implement locally tailored climate policies. These are Regional Environment Centres (RECs) and permit authorities, which have an important role in the regional/sub-national collection of information on environmental issues. They are also involved in land use planning, environmental education and campaigns to reduce greenhouse gas emissions (Ministry of the Environment 2009). Jointly with permit authorities, the thirteen RECs make decisions on environmental permits for large and medium-sized enterprises. Their mission and goals are defined by the Ministry of the Environment. However, RECs also prepare regional programmes providing guidance on environmental and land use planning. These are voluntary guidelines for cities to follow and they are influencing how cities are addressing the issue of climate change. Finland also has a number of other innovative national institutions that are facilitating research, commercialization and information to consumers on innovative technologies and practices *e.g.* in the area of energy efficiency (see Annex 1).

In **Japan**, environmental and energy policies are considered to be national government competencies, however national government can delegate its authority to governors and mayors to implement national

[27] It is important to note that KLIMP programme builds on a predecessor programme LIP, which targeted sustainable development from 1998 to 2003. This earlier programme is also estimated to have achieved significant CO_2 reductions, estimated to be 1.5 million tonnes CO2 per year in this period.

laws and regional and local governments can develop their own policies and measures whenever the central government does not act in the climate change sector (Sujiyama, Takeuchi 2008). The Kyoto Protocol Target Achievement Plan, introduced in 2005 and revised in 2008, aims to stimulate municipal and regional initiatives in the energy efficiency, transport and regional planning sectors (Government of Japan, 2008). It also encourages the use of JI and CDM to encourage achievement of low carbon objectives at local scale. Throughout Japan, local and regional governments implement and monitor their own climate action plan. Monitoring of municipal plans is often done by monitoring groups which include local stakeholders and decision makers (Sujiyama, Takeuchi 2008). In addition, several Japanese examples exist where regional and local governments are putting climate change regulations in place. This includes Tokyo and Kyoto prefectures, where Tokyo has introduced a mandatory cap and trade system in Japan as part of its climate change strategy[28] (City of Tokyo 2008). Kyoto has required a labelling system informing consumers about the environmental impact of their air conditioning appliances and televisions. The success of the Kyoto labelling policy led to similar a nationwide effort in 2008 (see Annex 1).

Another type of hybrid model has also emerged where the private sector is central and increasingly active to steer action through international or national carbon markets. These markets were created in part under the Kyoto Protocol as a tool for national governments to achieve aggressive mitigation targets in the 2008-2012 timeframe. In this market led example, there are top-down and bottom-up governmental as well as local private sector influences. This model may also be considered to be form of public-private partnership or "PPP" model of multilevel action on climate change.

Action in **São Paulo, Brazil** clearly demonstrates a PPP type of institutional model where a growing number of sub-national initiatives – both at state and local levels -- are being taken with the support of the national policy framework on climate change. As a Non-Annex I Party to the UNFCCC, Brazil has no national target for emission reductions however Brazil is active in its promotion and development of CDM projects. Since the early part of this decade, the City of São Paulo has considered climate change policies also within the context of possible solutions for local air pollution (Puppim de Oliveira, 2009). In 2003, the municipality joined ICLEI's Cities for Climate Protection (CCP) and completed an inventory of its emissions, showing that land transportation (48.6%) and landfills (23.5%) were the main sources of the city's GHG emissions. The city then developed several initiatives to mitigate GHG emissions centring on the use of CDM including a landfill project which is implemented by the City of São Paulo jointly with local private company Biogas Ambiental, in cooperation with German Bank KGW and the private firm Van der Wiel and Arcadis (Netherlands) (UNFCCC, 2005). The project generates energy from the landfill methane emissions has already reduced GHG emissions by 11% in the City of São Paolo (Cunha& Rei 2006). In 2006, 34 million Real (USD 16 Million) in revenues from the sale of carbon credits were invested in social projects in the area of the landfill and also on climate change mitigation (Oliveira, 2009).

The City of São Paulo is also acting in transport and building sectors. Specifically, the city introduced hybrid buses in the municipal transportation service and started a programme of automobile inspection and traffic restriction during the rush hour (Oliveira 2009). In 2007, the City of São Paolo passed a solar energy bill, now used as model by more than 50 other Brazilian cities (Cunha & Rei, 2006). The bill mandates, among other things, buildings with more than 3 bathrooms (homes, apartments, service or industrial buildings) to use passive solar heating systems. Expected impacts are 3400 tonnes CO_2 reduction and 8.7 million kWh of energy saved per year.

[28] The Tokyo Climate Change Strategy aims at reducing Tokyo's ghg emission from the 2000 by 25% by 2020. www.kankyo.metro.tokyo.jp/kouhou/english/pdf/TOKYO%20Climate%20Change%20Strategy%202007.6.1.pdf

Table 6. Frameworks and Institutional Models of Multilevel Governance on Climate Change

Location and implementing institutions	Type of initiative	Incentives for local action	Programme (s)	Key actors	Monitoring and assessment	Outcomes
Brazil/ São Paulo: City of São Paulo, State of São Paulo, international and national private sector	Hybrid/ PPP	• Local air pollution (transport emission reduction) • National/regional Economic Benefits from international Agreements	• Landfill emission reduction projects • Transport emission reduction • Development of a new-model vehicle emission standards (PROCONVE) • Solar energy Law (2007) • São Paulo State policy project (2009)	**i)Policy advocate** • Local and state authorities (Municipal committee for climate change and eco-economy, State Forum for Climate Change and Biodiversity) • International CDM project partners (Public/private) • ICLEI **ii)Targeted population** • Energy consumers • Car and property owners	**Local emission inventory** • City of São Paulo **GHG reduction under CDM projects** • PPP monitoring	• Economic benefits from CDM reinvested in social and climate policies • GHG emission reduction • State participation in climate policymaking
China: national government	Nationally led	• Economic incentives • Environmental problems	Enabling local and regional voluntary agreements	**i)Policy advocate** • National government • International community / EU **ii)Targeted population** • Municipalities • State-owned energy producers • Businesses in building and energy sector	Regional and National Environmental Protection Agency	• Empowered Regional Environment Protection Bureaus • Chinese "Environmental Model Cities'' • EU - Asia Pro-Eco programme in China (Voluntary approaches in environmental industrial management)
Finland: **• National government (Enabling)** **• Regional and local authorities**	Hybrid	• European commitment to the Kyoto Protocol	**Information development and exchange** • Motiva • Tekes **Sub-national actions** • AFLRA • ICLEI CCP	**i) Policy advocate** • Stakeholders; • Decision Makers; • Public administration; **ii)Targeted audience** • Researchers; • Businesses; • Communities; • Consumers.	**Ministry of Employment and Economy** • TEKES • MOTIVA OY **Municipalities** • AFLRA	• Regional and municipal action coherent with national objectives • Regional and municipal ghg emissions reports • Regional and municipal climate change action plans

Location and implementing institutions	Type of initiative	Incentives for local action	Programme (s)	Key actors	Monitoring and assessment	Outcomes
Japan: **• National government (Enabling)** **• Regional and local authorities**	Hybrid	• National enabling legislation for local and regional governments • Inaction in GHG reduction policy-making.	**Among others:** • Tokyo ETS • Kyoto Labelling System • Regional and municipal emission targets • Saga feed-in tariffs	**i)Policy advocate** • National policymakers • Local and regional policymakers • Local and regional public institutions **ii)Targeted audience** • Businesses • Industries / factories • Energy producers • Consumers	**Local action plans** • Yearly or periodic sectoral reviews done by monitoring group **Tokyo ETS** • Monitoring and reporting every year **Fifty-fifty programmes** • Municipalities and energy producers	• National implementation of eco-labelling program building on Kyoto local experience • GHG emission reductions from regional and municipal actions
Sweden: **Swedish Investment Support Council**	Hybrid	• Speeding up the transition of Sweden to an ecologically sustainable society; • Helping to raise employment levels.	**National investment programme** • LIP (1996-2002) • KLIMP (2003-2008)	**i)Policy advocate** • National government **ii)Targeted population** • Municipalities • Energy producers	**Swedish EPA** • The Agency re-evaluates the grants according to reported mitigation performances	• 3% reduction in GHG annual national emissions
US - Oregon - Portland: **• City of Portland** **• State of Oregon**	Locally or regionally led	Regional competitiveness and economic pole	**Green Building Program** • Technical assistance; • Grants from residential and commercial waste tax; **Green investment Fund** • Subsidy on exemplary projects. **Building Code**	**i)Policy advocate** • Citizen advisory group • Municipal bureaus • City of Portland • State of Oregon **ii)Targeted audience** • Technology suppliers and certified green buildings providers • Waste managers • Consumers/buyers	**Green Investment Fund** • 5% of total fund used by Portland Office of Sustainable Development to monitor programme	**Participation of State-level institutions** • OHCS • Creation of Oregon BEST in 2007

Incorporating climate change into existing national, regional and urban development frameworks

A main challenge for national climate strategies is how they are integrated within existing regional and urban development policies frameworks that most OECD countries have had in place now for decades.[29] A brief review of practices in OECD highlights the following trends. [30]

Within the OECD, application by national governments of regional policy using a "green" lens, or the pursuit by central governments of climate change strategies using a regional development policy filter, is uneven. Japan and Korea currently appear to have developed the most comprehensive of approaches to green regional (urban) development strategies of the OECD countries (Box 6). More generally:

- Only a minority of OECD countries is applying a climate change lens to the implementation of regional/territorial/spatial economic development policy frameworks. What appears to be the norm are the parallel application of regional development policies on the one side, and the pursuit of targeted sectoral strategies directly or incidentally addressing climate change. In most cases these are decoupled from each other.

- Sectoral strategies may be applied without regard for regional or local strengths and assets. A regional development policy lens may not be used at all when designing sectoral strategies to address climate change.

- Cross-sectoral, holistic regional approaches to address climate change by central governments appear to exist in only a few instances *e.g.* in Japan, Korea and Sweden. In most countries, a significant coherence/coordination challenge exists in the implementation of the various climate-change and regional development spatial plans: little if any coordination exists between the various scales of regional and local planning instruments.[31]

- The most effective cross-sectoral strategies appear to be those where climate change mitigation and adaptation is seen to be a potential source of regional economic development/growth. By contrast, strategies based on adding a "green" component in a more isolated manner to sectoral regional development policy drivers (for example, infrastructure development), seem less likely to successfully sustain regional economic development and tackle climate change over the longer term. This assumes that national governments accept that economic development and environmental sustainability are not an either/or proposition but rather are synergistic.

As climate change becomes an increasingly important policy driver for central governments, and especially in the context of the 2008-2009 economic crisis, a robust quantitative, outcomes-driven evidence base is required to inform sound public policy development and implementation aimed at sustainable regional economic development. Currently, large information gaps remain across the OECD membership related to inter-jurisdictional comparability, common indicators and metrics to measure success and perhaps most importantly time-series data to measure the impact of cross-sectoral climate-change

[29] . See www.oecd.org/gov/regionaldevelopment

[30] .These are the findings from the answers to the questionnaire and the discussion that followed at the OECD Ministerial Meeting on Regional Development, March 30, 2009. These were compiled by Adam Ostry, Chair of the OECD Working Party on Urban Areas.

[31] .These include the regional (CEPR) and the local development plans (PLU - plans locaux d'urbanisme), the Territorial Energy and Climate Plans (PECT - plans énergie-climat territoriaux), the Terrirorial Coherence Plans (SCOT - schemas de cohérence territorial), the Urban Transport Plans (PDU - plans de déplacement urbains) and the Urban Planning and Sustainability Plans (PADD - projets d'aménagement et de développement durable).

strategies on regional economic development and vice versa. Strengthening empirical evidence will advance understanding about what climate change regional and urban development practices are performing well and why and support the sharing of lessons learnt between member countries.

The OECD (2009) *Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation* suggests an integrated approach to adaptation. This guidance described core decision-making and policy processes as well as key actors at each level. It also describes the governance architecture and steps within the policy cycle relevant to each level. It identifies particular *entry points* along the cycle where consideration of adaptation could be incorporated. These entry points provide opportunities for the identification, integration and implementation of measures and investments specifically designed to enable and support adaptation but which had not been envisaged in the initial plan, programme or project (OECD, 2009e).

Box 6. Regional Policy and Climate Change: examples from a selection of OECD countries

In **Japan**, the central government is currently pursuing a "Compact City" urban greening policy because of the positive externalities on the environment. Reduced greenhouse gas emissions is a positive outcome of Japan's strategies to affect a modal shift away from private motor transport in its urban agglomerations, whose main aim is to reduce congestion and costs to business activity and productivity. Under the Compact City policy framework, the central government is focusing on generating a more compact urban structure with its 2006 revisions to its *City Planning Act.* These revisions introduce measures to control sprawl through more stringent land-use planning and development regulations. A related initiative, the Comprehensive Urban Transport Strategy, aims to ensure that citizens in urban areas can live with less dependence on the automobile, by targeting investments at light rail/light rapid transit and by zoning to combine functional activities related to commerce, housing and industry around LRT stations. Under this strategy, city administrations are encouraged to modify their own transportation initiatives to favour public transport over road construction, with assistance from the central government. At the same time, as a means to promote a "race to the top", the Japanese government has introduced the recognition of an "Environment-Friendly Model City" as a means to share best practices relating to the promotion of compact urban form and lower GHG emissions among urban centres across Japan. The first urban centre to receive the designation was Kitakyushu-city in 2006.

What **Korea** calls its "Korean-Style New Deal" to address the current economic crisis aims to contribute simultaneously to creating new jobs and respond to climate change. The project aims to support the construction sector in supplying energy-saving, eco-friendly "green" homes and building transfer nodes for low-carbon, mass-transit infrastructure such as high-speed rail. The government of Korea has explicitly underscored in its "New Deal" that it seeks to counter the conventional view that economic growth conflicts with environmental protection. On the contrary, a principle at the core of its approach is the synergy between economic growth, job creation and environmental protection and enhancement.

Australia has identified climate change adaptation and mitigation as its top emerging issue for regional policy design and implementation. Indeed, as part of its regional policy framework Australia has recently introduced a Climate Change Action Fund to assist regions and communities in adjusting to a low-pollution future as well as a Carbon Pollution Reduction Scheme for Australian households.

In **France**, the current round of regional development plans (CPER contrats de plan État-Régions) for 2007-2013 now contains a carbon-neutrality objectives: any infrastructure project financed under a CPER that leads to the generation of emissions (a highway, for example) must be offset by other projects that will reduce emissions (like public transit, for instance). The French government's national climate change framework is also being planned using an urban lens: the "Grenelle de l'Environnement" provides for the extension of the existing climate-energy plans, the strengthening of environmental assessment components in urban planning, and the inclusion of anti-urban-sprawl objectives, measures to limit greenfield development and the development of eco-friendly districts/neighbourhoods in urban planning approaches. In light of pending legislation in the Grenelle II process, the voluntary nature to date in France of local-scale greenhouse gas inventories will be modified. Article 26 of the Grenelle II text lays the groundwork for mandatory GHG inventory reporting for urban areas greater than 50,000 people, public entities larger than 250 employees and private entities with more than 500 employees. The required inventories for urban areas are to be used in the development of a Plan Climat (Climate Action Plan) and are equally required for cities larger than 50,000 people.

Austria has identified climate-change adaptation and mitigation as a top emerging challenge in implementing its regional policy framework. In the **United Kingdom**, within the framework of Regional Development Agencies, a new performance framework for local authorities incorporating climate objectives, as well as new local transport legislation, which gives more authority to municipalities in transportation policy.

The **Czech Republic** has identified as a top emerging issue for its regional policies the improvement of the economic and environmental potential of its regions, the revitalization of its decaying districts and the sustainable development of its rural areas, while **Germany** will focus part of its regional policy approach to implementing the EU cohesion policy on reconciling climate-change objectives with its goals for regional economic growth. **Greece** also identifies climate change as a key emerging issue in its regional development policy framework.

The **European Union** itself, under the French presidency in 2008, expressed the need to incorporate a territorial-based approach to climate change, to mainstream climate-change issues in spatial development policies at all levels of government in the Union and to integrate risk-management considerations into spatial development policy, including risks to the environment.

In **North America**, the three central governments of Canada, Mexico, and the US have to varying degrees adopted elaborate climate-change strategies. Each also has in place longstanding regional development policy frameworks. That said the links between the two are tenuous; at best, they are sectoral and uneven.

In **Canada**, infrastructure investment policies focus to a significant degree on green infrastructure initiatives from public transit to water, wastewater and solid waste and community-based renewable energy systems. Infrastructure investments reflect regional circumstances, especially in programming that requires the support (and investment) of the provincial government for a project in a given region to receive federal funding. Federal infrastructure programming is implemented outside the regional development policy framework, even if it is often delivered regionally through the federal Regional Development Agencies. Federal sectoral support in areas that affect climate change, such as support for eco-friendly housing projects or for new technologies for energy generation, for example, are also applied a-spatially across Canada, outside the country's regional economic development policy framework.

In **Mexico**, the federal government explicitly recognizes the link between urban competitiveness and urban attractiveness and livability, including environmentally friendly urban development. Indeed, the government goes further, basing policy directions on the premise that in the future, urban competitiveness will constitute the outcome of the adoption of climate-change policies and strategies. Through its Ministry of Social Development, the government is pursuing its urban development policy framework using a climate-change lens, with a focus on public transport corridors and urban mobility, maximizing urban public green space and more effective waste disposal technologies to reduce GHG emissions.

Addressing national barriers to local action

Beyond specific programmes that have been developed to promote climate change action at the local level, municipal governments can be restricted by existing policies. Pre-existing policies, many of which have been in place for decades, were developed before climate change emerged as a significant issue. Across a number of countries, local level officials have indicated that national policies can reduce their capacity to act in a number of areas. In Norway, local municipalities have reported that large-scale flood defence schemes have undermined their ability to develop more robust, locally calibrated systems. In the UK, local authorities note that short-term budget cycles pose significant difficulties in the development of long-term initiatives. Further, at the EU level, relatively 'static' biodiversity protection requirements have made it difficult for some areas to implement managed retreat adaptation as a preferred management policy (Urwin & Jordan, 2008).

In a top-down and bottom-up analysis of policies in the agriculture, water and nature conservation sectors in the UK, Urwin and Jordan (2008)[32] revealed a number of synergistic as well as antagonistic

[32] This is a study reviewing the United Kingdom Climate Integration Program (CIP)

interplays between national polices which often served to constrain local action on climate change. Table 7 presents those policies identified by local-level officials as being antagonistic to the implementation of adaptation policies.

The policies highlighted typically apply to specific sectors, however it can be expected that policies from other areas, which traditionally have not integrated environmental nor climate considerations, could provide the wrong incentives for investment, leading to mal-adaptation or mal-mitigation. It may be an impossible task for central policy makers to alter and re-evaluate every counterproductive policy that could create antagonistic interplay, especially given that there is a variety of competing policy priorities. However there may be some key actions that can assist with comprehensive alignment across policies. For example, in the case of new policy in the UK, one suggestion from Unwin & Jordan is to incorporate climate change issues directly into mandatory regulatory impact assessment (2008). In any case, working directly with municipal authorities in this process will be important as they may be in the best position to experience first-hand the obstacles, as well as the benefits, that interplay can create (Urwin & Jordan 2008).

Table 7. Examples of antagonistic interplays among adaptive sectoral policies with respect to adaptive responses: a bottom-up perspective

Sector	Adaptive response	Dissonant policy	Reason for antagonism
Agriculture	On-farm reservoir	1975 Reservoirs Act	Increases time and cost involved
	Long-term planning	2003 Water Act	Time-limited licences and potential for revocation of licences increase uncertainty
	Increase irrigation	1992 Habitats Directive	Influence availability of water for agricultural use
		1991 Water Resources Act	Possible for the Environment Agency to impose restrictions in times of water shortages
	Diversification	ERDP (AE and energy crops)	Schemes often too narrow and inadequately resourced
Water resources	Ensure future water security	ODPM's 'Sustainable Communities' initiative	Development in water scarce areas will exacerbate problems of water supply
		Planning Regulations 1999 No.3280	Water companies not a statutory consultee regarding proposed new developments
		2003 Water Act	Time-limited licences increase uncertainty in future planning for water companies
	Demand-side management	1999 Water Industry Act	Lack of compulsory metering
		2000 Building Regulations	Water efficiency measures not statutory requirements for new developments
Nature Conservation	Sensitive land use management	1992 Habitats Directive, 1981 WCA	Too much emphasis on designated sites
		AE schemes	Too fragmented and inadequately resourced
		Agricultural tenancy law	Difficult for conservation organisations to regain control over land
	In situ conservation	Biodiversity Action Plans	Lack of explicit inclusion of climate change within species and habitat action plans
	Habitat recreation	1975 Reservoirs Act	Increase the time and cost of wetland recreation projects
		PPG7 and RPG6	Need to store soil if land being reclaimed from agriculture
		Town and Country Planning Acts	Restrict location of projects (cannot be in vicinity of airports)

Source: Adapted from Urwin & Jordan (2008).

Specifically on the issue of adaptation, the OECD has advanced the notion of applying a *climate lens* in development planning. A climate lens is an analytical tool to examine a strategy, policy, plan, programme or regulation. The application of such a climate lens at the national or sectoral level involves

examining: *(i)* the extent to which a measure – be it a strategy, policy, plan or programme – under consideration could be vulnerable to risks arising from climate variability and change; *(ii)* the extent to which climate change risks have been taken into consideration in the course of the formulation of this measure; (*iii)* the extent to which it could increase vulnerability, leading to maladaptation or, conversely, miss important opportunities arising from climate change; and (*iv)* for pre-existing strategies, policies, plans and programmes which are being revised, what amendments might be warranted in order to address climate risks and opportunities (OECD, 2009f).

Summary points

This section addresses particularly the question of how to design national policy frameworks to support local level innovation and action to mitigate and adapt to climate change. It underscores a variety of institutional and economic factors that shape decision making on climate change across levels of government. These include not just the costs and benefits of action or the co-costs and benefits but also what the formal functions and legal authority exist, what responsibilities and roles of government are at different levels, who the main actors are, and what tools are available to support decision making. For a variety of reasons, it is in the interest of national governments to empower local actors and particularly local governments to address climate change.

Several examples explored here highlight a variety of institutional models national-local linkages on climate change may take. National enabling policy may mandate or strongly recommend a specific set of policy actions at local scale, as in the case of the required development of local climate plans in Norway or in China. A second model is the bottom-up, locally led model where independent local action generates innovative ideas or policies that can be tested and refined locally and later used as a template for broader action at regional or national scale. This is shown to exist in the US, where there is a weak national policy framework for climate change, as well as in other locations. A third model is referred to as "hybrid", where national (or regional) governments work closely with local governments to stimulate two-way learning. This is the case of the Swedish KLIMP funding program; they can provide a voluntary framework to incentivize action through funding or support for activities. In the Swedish case, local communities compete with each other for central funding of mitigation or adaptation options where key disbursement criteria are based on expected performance and local implementation/evaluation plans. The example of Japan illustrates an even more decentralised approach where enabling legislation explicitly recognises and calls on local government to act. In this context, there is room for innovation at the local level and some ideas, such as the use of energy labelling, was initiated and tested locally before being diffused more broadly. Yet without a strong national policy framework to ensure broad diffusion of key actions, these examples may remain isolated. Another is example is found in Sao Paulo where local and national governments work closely with private sector actors to facilitate action at local scale, for example through the use of offset mechanisms in the international carbon market (*i.e.* JI or CDM).

This section has also reviewed how regional economic development policy at national level is being advanced with use of a "green" lens, or alternatively the pursuit of national climate-change strategies using a regional development policy filter. A "paradigm shift" is required to move away from perceiving growth and sustainability as an either/or proposition to defining the two policy objectives as linked and mutually reinforcing (OECD, 2006 and 2009). This paradigm shift is already happening in many responsibility centres across national governments. At issue, however, is whether national governments accept this premise generally and most importantly whether within national governments each responsibility centre with authority over issues related to climate change and regional economic development fully understands the need for change. What follows from this is the challenge of intra-governmental coordination and coherence in developing and implementing cross-sectoral approaches aimed at pursuing regional development objectives using a climate-change or more broadly a sustainability lens.

Finally this section addressed the question of incentives for action across levels of government, demonstrating how a large number of pre-existing policies may incite mal-adaptation or mal-mitigation, working counter to any progress made in more targeted climate policies. To ensure progress in the aggregate, across the entire socio-economic system in any one nation, this calls for more systematic, integrated or comprehensive efforts to align incentives across sectoral and cross-sectoral policy areas to reflect climate change objectives and deliver policy coherence. Recent work at the OECD has called for the use of a "climate lens" in development planning.

5. BUILDING INSTITUTIONS TO ENHANCE LOCAL KNOWLEDGE AND STRENGTHEN ACTION

As highlighted in the introduction, a multi-level governance framework can help to accomplish an essential task to bring democracy and deliberation to the issue of how to address climate change. This includes openly acknowledging that the "state" -- in the form of government or public authorities – are not the only relevant actors and to take into account a wide range of non-state actors at different stages and scales of decision making. Building institutions (whether they are formal or informal) can help to bridge different perspectives amongst a variety of actors, to enhance local knowledge and understanding, and to contribute to the climate policy formulation and implementation climate change.

This is consistent with insights from social research on the need to consider the contribution of institutions as they shape individual and collective behaviour and in particular the need to create opportunities and outcomes for collective decision making (North 1990; Ostrom 1990). The model that emerges places some emphasis on local action to create "deliberative spaces" can raise stakeholder awareness, build trust and understanding and ultimately facilitate collective decision making and collaboration to protect common environmental resources (Ostrom 1990; Ostrom 2000; Ostrom *et al.* 2002), in this case the global atmosphere.[33] In particular, the scientific complexity and uncertainty surrounding predictions of climate change at local scale requires special attention. This strengthens the argument for a more reflexive approach to climate policy decision making, one where risk management is at the centre and one that relies on multi-stakeholders at the different stages of the policy process.

Analytic-deliberative capacity and policy networks formation

One model that can be used to apply this concept of multi-level governance and to understand and facilitate interactions between different actors is the following:[34]

- a **"core area"** of public decision making with institutions that have formal governmental decision-making powers, *e.g.* governmental administrations, judicial system, and parliamentary bodies.

- an **"inner periphery"** operates close to the core and includes a range of institutions that have a degree of autonomy and self-governance functions. These institutions are equipped with rights and self-governance delegated by the state (*i.e.* universities, public insurance systems, professional agencies and associations, charitable organisations and foundations).

[33] This perspective reinforces the importance of dialogic processes – of dialogue and of the notion of trust - by offering opportunities for meaningful exchange among affected stakeholders, including experts, and in so doing to build human and social capital that contributes to problem solving over time (Bohman 1996; Dietz 2003b; Healy 1997; Rydin 2003).

[34] This is based on Corfee-Morlot 2009 where this is referred to as a "Habermasian model of circuits of power" (Habermas 1998: 354).

- an "**outer periphery**" of policy action, which encompasses a wider variety of "suppliers" of information and ideas for policy decisions and "customers" who are the target audience of decisions. This includes experts, businesses, and consumers as well as the media; it is the civil-social infrastructure of the public sphere.

To be legitimate, binding decisions "must be steered by communication flows that start at the periphery and pass through sluices of democratic and constitutional procedures…" (Habermas 1998: 356). This model of decision making emphasises the social integration function of public discourse and decisions, where the true outer periphery is part of the civil-social infrastructure of the public sphere, and where communication and local understanding is facilitated by the mass media.

In the case of multilevel governance of climate change, this model can assist the achievement of two main objectives: (i) to support an ***analytic-deliberative exchange*** between experts, governmental partners and stakeholder to facilitated understanding of risks of and opportunities of climate change in regional and local contexts (Corfee-Morlot 2009; Stern and Fineberg 1996); and (ii) to facilitate formation of ***policy networks*** at the urban scale.

(i) Regarding ***analytic-deliberative exchange***, this provides a means to "understand" climate change; as with any environmental issue, understanding is inevitably linked to scientific knowledge. However, the case of climate change may be somewhat different than many environmental problems in that it presents large scale, systemic risks that unfold over long time frames and asymmetries across geographic scales that challenge conventional decision models. Thus how climate change is framed and addressed in the public sphere will depend upon the interaction between science, the media and other socio-political processes (*e.g.* Corfee-Morlot *et al.* 2007; Liverman and O'Brien 2001). In this light, understanding the risks of climate change at city-scale can help cities to better work in tandem with the national government to manage national risks more efficiently, to achieve both adaptation and mitigation outcomes. Beyond the scientific issues are a range of technical issues such as understanding the sources of emissions, their magnitude and linkages to human economic activity, and thus opportunities for cost-effectively managing these emissions. Local governments have a particular role to play to build on local knowledge and create a "policy space" for a deliberative-analytical exchange to help create a climate-friendly vision of the future (Stern & Fineberg, 2006; Grindle & Thomas, 1991; Corfee-Morlot, 2009).

The interaction with national governments is particularly relevant in this context as they have a key role to play to enable the analytic-deliberative process on climate change at local scale. This may include ensure that policy relevant scientific information, *e.g.* on climate change impacts, is available and that interactive exchange between local decision makers and scientists is regularized. It may also include making available of standardized tools for accounting for and assessing cost-effective management of emissions.

(ii) Regarding policy networks, this follows the definition of Borzel (1998) to include "a set of relatively stable relationships which are of non-hierarchical and interdependent nature linking a variety of actors, who share common interest with regard to a policy and who exchange resources to pursue these shared interests acknowledging that cooperation is the best way to achieve common goals." Applied to urban policies and politics, the concept of policy networks highlights the importance of trust, legitimacy and accountability of local institutions that goes beyond the principle of local democracy embedded in individual municipalities but rather depends on different forms of public support and participation modes of non-governmental actors at the different stages of the decision making process (OECD, 2006).

This is particularly relevant and crucial in the field of climate change for which, as mentioned in the previous chapter, public awareness and mobilisation of local "voices" constitutes a prerequisite for the adoption of actions and policies. Indeed, local government authorities cannot effectively address the

massive challenges posed by climate change without widespread grassroots involvement of a wide variety of actors in civil society, such as citizens' groups, neighbourhood associations and the business sector. These non-governmental stakeholders can play key roles in both contributing to the development of sound government policies, and in ensuring that such policies are effectively implemented. They can also play the role of messengers and catalysts for community action and they can be engaged and participate in policy design and delivery. If excluded from the decision making process, they can also represent powerful obstacle for the adoption of climate change action plans and/or implementation, or limit their effectiveness.

Following this model which is based on the dual concepts of analytical deliberative capacity and policy networks formation, this section will first discuss different tools that national governments can develop to support local decision making. Two examples are explored: GHG inventories; and sub-national science-policy exchange. Second, the section turns to the role of non-state and non-governmental actors in the different stages of the policy decision making process, from formulation to implementation and dissemination. The aim is to assess to what extent the different mechanisms can help to the formation of policy networks as an essential part of the multi-level governance process for climate change. Within this is the sphere of interaction that contributes to and promotes analytical deliberation through national and transnational networks of cities and regions. These networks are essential in identifying and disseminating relevant knowledge and best practices among sub-national governments.

Developing the toolbox to harness city-scale decision making

As noted, there are two core activities that national governments could support to help cities become more effective in the design and delivery of locally tailored policy solutions to climate change. First is the development of city-scale GHG inventories such that mitigation performance can be monitored, supported and compared across urban jurisdictions. Here both national and international attention to the challenge will be required to advance the development of the necessary tools. Second is the need for regional science-policy capacity to support timely and cost-effective adaptation at local scale; a similar need could be highlighted for regional capacity to assess the economics or costs of mitigation or adaptation policies. Progress in both of these areas could build crucial capacity at local scale to address climate change and require support from national governments.

Monitoring progress: cities, mitigation and GHG inventories

Cities have been active in efforts to reduce greenhouse emissions for at least a decade and the level of ambition and scale of statements of intent to mitigate have grown with time.[35] However, there is a need for cities to bring rigour and structure into their efforts to measure progress in achieving their mitigation goals. Today we still lack harmonised, internationally agreed-upon methods and inventory data to assess progress within and across cities.

One prerequisite is to establish a common set of metrics for comparison of progress across cities. Agreement on metrics, methods and reporting frameworks for cities can establish a common language for cities to speak to each other, to measure progress and assess performance (both ex ante and ex post policy implementation), to identify and share understanding of best practices in urban-scale mitigation activities. In addition, emerging carbon markets could provide cities a starting point to leverage their otherwise limited resources. The necessity of rigour in local-scale GHG accounting is virtually incontestable given that almost any form of access to carbon-finance will require harmonised inventory methods, reporting and data sets.

[35] For example, following an initiative of city of Seattle's Mayor Greg Nickels. To date more than 900 U.S. cities have announced plans to achieve Kyoto-like emission reductions. These ambitious goals imply bringing city emissions to below 1990 levels by 2012 (www.seattle.gov/Mayor/Climate/).

There are several reasons to harmonise urban GHG inventory methods. Firstly, a common framework will allow cities to assess progress over time as well as across locations. In turn this will allow them to compare results and cost-effectiveness of emissions reductions at the sector level – for example in the waste sector, in the transport sector or residential/commercial building energy end-use sector.[36] Furthermore, such a tool can indicate how they stack up, for example in comparison to other cities of similar wealth, population, or geographic/climate characteristics, and to understand how and why major changes in emissions occur over time. In this way, it will open new possibilities for cost-effective mitigation, as well as for collaboration and learning across location.

Secondly, harmonised urban inventory methods and reporting is essential to enable performance assessment and comparison across urban locations within a nation, for example, to assist national decision-makers to better understand the potential for, and overall mitigation progress made, at urban scale. Harmonised urban inventory methods can also provide inputs for preparation of national inventories and emissions targets, and an information base to allow national policymakers to reward or incentivize urban-level emissions reductions.

Thirdly and finally, with standardised local measurement approaches in place at the international level, city scale policies could lead to measurable and verifiable emission reductions that are eligible for certification and sale through existing mechanisms under the Kyoto Protocol (*e.g.* joint implementation or the clean development mechanism) or similar mechanisms that are expected for a post-2012 agreement. Although there is some progress in making national and international carbon finance available at urban scale (Bodiguel *et al.,* 2008; Roberts 2008), much more could be done. This could open the way for new sources of funding to city-scale mitigation efforts, helping cities to exploit least cost options for reducing emissions in the coming decades.

The urban inventory challenge

What is standing in the way of inventory harmonisation at urban-scale? As was the case for national government, cities require solid technical input and international support to connect their inventory approaches or protocols to existing IPCC guidance and UNFCCC national reporting systems. Without these critical links to the institutional framework that has emerged to support international monitoring, review and verification process under the Convention, it will be difficult, if not impossible, to integrate urban-level mitigation action into emerging regulatory frameworks and markets for emission reductions.

This recommendation draws on past experience in the building of reliable and transparent international monitoring systems to support improved environmental decision making and performance. Today parties under the UN Framework Convention on Climate Change (UNFCCC) have adopted the IPCC methods as a standard framework for preparation of national inventories. National GHG inventories provide solid, comparable and verifiable emissions data at the national level to support peer-review and transparent assessment of mitigation performance under the UN Framework Convention on Climate Change and the Kyoto Protocol over time.[37] Importantly this system, when combined with other tools to ensure the quality of information and the ability to accurately track compliance and transactions, has enabled the creation of an international carbon market. That market has grown significantly in recent years,

[36] Industry emissions may vary widely from location to location or even over time within a single location, *e.g.* as industries increasingly move outside of city boundaries this may dramatically change urban emission levels. Decisions of city governments may also have little influence over industry emissions relative to large influence of local policy over residential and transport emissions. Thus special attention to this source of emissions may be warranted in the assessment and comparison of urban emission performance across cities.

[37] For access to latest inventory reports and data see: *www.unfccc.int* [last accessed 8 December 2008].

with total value to equal about USD 64 billion by 2007, more than doubling in value from 2006 (Capoor and Ambrosi, 2008).

Assuming that comparability across entities is desirable, the IPCC guidance for national inventory preparation is a necessary starting point (UNFCCC, 2002a). For example, in response to the need for harmonised approaches for "entity-level" reporting, the World Resources Institute and the World Business Council for Sustainable Development (WBCSD) collaborated to develop "The Greenhouse Gas Protocol", primarily for corporate use to track emissions (WRI/WBCSD). It builds on the IPCC guidance, but adapts it for use at a different level or scale of activity.[38] In recognition of the importance of the public sector and to better address their needs, the WRI/WBCSD is currently developing a *Public Sector Protocol* in cooperation with the US Logistics Management Institute (LMI), the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) with a slated delivery data of early 2010. However, the approach remains constrained to tracking "entity-level" emissions.

To date no single protocol or set of process guidelines has been adopted to harmonise compilation of data, estimation of emissions or reporting of comprehensive urban inventories including both operations-related [39]and territory-wide emissions. As a result, cities have taken different approaches in defining what sectors to include, in establishing the geographic boundaries of the area included, as well as in aggregating data in different ways. As such, any comparison across existing inventories is hampered. As such, a number of competing inventory protocols exist that have been used in data collection and inventory preparation at city level.

First, at the local/regional level, the California Climate Action Registry (CCAR) is the first state registry to have developed a standard inventory protocol and set of methods for inventory preparation by cities building directly on the WRI/WBCSD work (CCAR, 2006). In 2006, San Francisco became the first city in the United States to submit an inventory validated with the CCAR protocol, which focuses on city operations.[40] More recently, a number of U.S. states have formed "The Climate Registry" which is intended to establish a harmonised system for entity level reporting across participating states and could expand the influence of the CCAR city-scale protocol.

Second, as a transnational network, the ICLEI Cities for Climate Protection program[41] has been active worldwide over the last decade to support mitigation action at the local level (see also below). Each of its more than 700 member local governments has committed to produce an emissions inventory using the protocols, guidelines and accompanying software developed based on the work of the WRI/WBCSD.[42]

---

[38] It is important to note that a number of different registries and protocols exist in the United States to serve different purposes, some of which are mentioned here. Because there is no single top-down mandatory federal system requiring entity or state-level reporting, a patchwork of state systems, some of which are mandatory, combine with voluntary reporting. For a review see Rich, 2008.

[39] Operations-related emissions are those that stem from the functioning of the municipality as an organizational entity. Territory-wide emissions refer to all the emissions related to the economic and social activities found on the geographic territory over which the local government exerts control.

[40] CCAR. 2006. San Francisco first city in U.S. to certify greenhouse gas emissions. Los Angeles: California Climate Action Registry.

[41] ICLEI is the International Council for Local Environmental Initiatives, which now also operates a Cities for Climate Protection Campaign. See *www.iclei.org/index.php?id=800* [accessed 12 November 2007].

[42] ICLEI released in 2008 its International GHG Emissions Analysis Protocol, reviewed by UNEP, WRI, the IEA, CCCAR and a number of other organizations. To facilitate the production of emission inventories, ICLEI has developed two software emission calculators, the *Clean Air and Climate Protection* software and the recent online *Harmonized Emissions Analysis Tool* (HEAT).

Embedded in the protocols and software are a number of inventory methods and a simple reporting structure as well as the possibility of tailoring to different national contexts. However, cities have wide choice in how they conduct inventories (geographic scope, sectors, etc.) and the ICLEI guidance points out that it is a tool explicitly developed to enable city management of emissions over time rather than to permit cross-city comparisons.[43]

Third, there are some specific national examples, such as in France the Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME), an inter-ministerial body working on environmental issues, has created the Bilan Carbone (ADEME, 2008), an emissions accounting system developed for both corporate as well as municipal users. The tool looks at both city operations as well as emissions occurring within the geographic boundaries of cities, focusing on 10 primary emissions areas: energy generation, industrial processes, the service sector, residential, agriculture and fisheries, freight, passenger transport, construction, and waste disposal. The Bilan goes beyond direct and indirect to include the emissions associated with products consumed (*e.g.* emissions embedded in the production of cement used in city infrastructure) as well as the tourism-related air travel for destination cities. The ADEME has also established a structure both to train evaluators and to partially finance local-level inventories through grants. Developed in part by the national government, many French cities have used the Bilan Carbon to evaluate their emission levels. However, as with the ICLEI inventory tool, cities have choices in what they include in their inventory. As a result, application of Bilan Carbon leads to incommensurable results across applications.

A recent review of selected city inventories (see also Corfee-Morlot *et al.* 2009) provides an overview of the range of technical issues embedded in the task of inventory preparation that influence comparability. Beyond differing reporting formats or inventory construction protocols, these features include:

- Different definitions of the urban area (*i.e.* is it defined by the larger metropolitan region or the city limits, or by something else),
- Choice of inventory years presented,
- Scope or boundaries of the inventory, *i.e.* whether or not more than city-owned operations are reported, and whether indirect emissions are included or not: *e.g.* treatment of electricity emissions,
- Methodological issues.

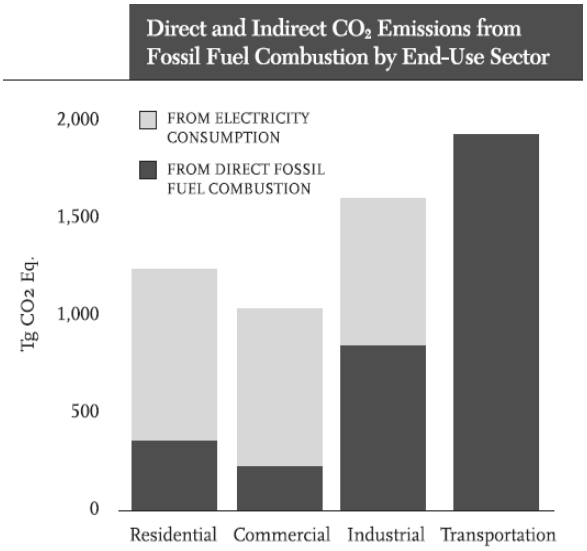
A review of each of these issues in turn provides insights to the complexity of developing comparable inventories. A key issue is the geographical boundaries as well as the technical boundaries for inventories. As Diane Wittenberg, then president of California Climate Action Registry (CCAR) commented in 2006: "*The hardest part is boundaries, what's in and what's out… some of them are reporting [individual] buildings in the city, and others are skipping things like the airport. And you've got everything in between. …so we're looking forward to tightening up the way that cities are reporting."*[44] Table 8 considers a selected number of U.S. and Canadian cities indicating the range of choices. Some urban areas limited their study to administrative boundaries (*e.g.* Seattle, Toronto, New York City), while others chose to include the entire metropolitan zone and/or the surrounding region (*e.g.* Vancouver, including the Lower Fraser Valley). The choice of inventory years also appears to vary widely across cities. On the scope of GHG covered, the majority of the inventories outlined in Table 8 take both direct and indirect emissions into

[43] *www.icleiusa.org/cacp* [last accessed 12 December 2008].

[44] This is taken from a discussion in Corfee-Morlot 2009.

consideration. Direct emissions are those produced by operations occurring within local boundaries by local activities, such as transport, commercial and residential fuel combustion, industrial production or processes as well as the treatment of waste. Indirect emissions are those resulting from energy use or imports but where the emissions occur outside local boundaries (*e.g.* electricity or steam production). Central to the question of direct or indirect emissions accounting is how to deal with the electricity sector. Most often electricity is generated outside city boundaries but largely consumed within them *e.g.* by residential and commercial customers (Figure 6.).

Figure 6 . U.S. National CO2 Emissions, by End-Use Sector



Source: U.S. EPA (2007) as cited by Rich 2008.

Beyond the challenge of addressing electricity emissions for urban energy use is that of how to address emissions embedded in products purchased and used in cities. These more extended analyses represent the "carbon footprint" of urban consumption activities, but go beyond the accounting of emissions within administrative geo-political boundaries, which has been adopted by the IPCC national GHG inventory guidelines (UNFCCC, 2002). Accounting for city-scale carbon footprints could be an important tool and source of information to support policies that target consumer behavioural change to limit emissions, but for consistency of reporting purposes, these emissions must be separable.

Another important boundary question is how emissions from the transport sector are accounted for. There is no harmonised approach or broad agreement on how best to allocate a share of national or regional transport activities to urban areas. A variety of different models and assumptions are possible, each with different outcomes.

Finally, there are other methodological differences associated with individual emission source categories. These include, for example, how to estimate the emission factor for electricity when emissions will vary by type of primary energy used to generate electricity? Beyond limiting the ability to compare emissions between cities, the level of aggregation and choice of methods to estimate and report emissions may alter the usefulness of the inventory for policy development. These differences suggest the urgent need for a harmonised set of methods and reporting protocols.

Towards harmonised reporting, comparable data

While a number of different inventory protocols exist, an increasing number of cities have undertaken urban emission inventories in recent years. To date, only two programmes are attempting to consolidate these inventories using a formalised reporting process. The first is the ICLEI CCP campaign noted above. However, given the lack of standardisation in reporting or inventory construction, the city inventories prepared under the ICLEI effort are used to monitor performance across time within a single city rather than to compare performance or trends across cities. While ICLEI has recently taken a step forward with the introduction of its online HEAT analysis and reporting tool, its use is guided by protocols and guidelines that allow substantial variance between applications. Second, the Climate Alliance's Local Governments Climate Partnership is also working to compile and compare emissions data from participating cities in Germany, the United States and Japan (Climate Alliance, 2008).[45] This program was launched in early 2008 and at time of writing has yet to report its results.

Groups such as ICLEI have made an excellent start on developing rigorous protocols and guidelines in cooperation with the World Resources Institute and the CCAR. In 2008, a program-neutral emissions reporting protocol was developed in the United States/North America for use at the local-level in cooperation between WRI/WBCSD, the California Climate Action Registry (CCAR), the California Air Resources Board (CARB), ICLEI-US and The Climate Registry. The resulting *Local Governments Operations (LGO) Protocol* is a programme-neutral document containing general guidance on the specificities of calculating emissions from local government operations. Each of the participating entities have equally developed separate, programme-dependent supplements to be used in conjunction with the LGO Protocol.[46] Further, the above-mentioned WRI/WBCSD *Public Sector Protocol* recommends that local governments using their standard consult the *LGO Protocol* for guidance compatible between the two documents. While the protocols remains focused on operations-related emissions, a territorial-based approach is currently in discussion. However, to be fully operational and accepted, exemplary efforts such as these will need to be vetted and eventually endorsed by institutions formally charged with establishing monitoring requirements at national and international scales (*i.e.* the IPCC).

As with the challenge of developing firm-level reporting guidance – which was led by WRI/WBCSD – the tools that cities use to monitor progress will need to be linked up or nested in the IPCC GHG inventory guidance to avoid double-counting with other local authorities or even across sectors as national governments establish nationwide policy frameworks. It will require support and resources from both national governments and the international community, including from experts engaged in the review and monitoring taking place under the Convention. While it would take time and resources to get such a system up and running, it would be a step in the right direction to empower cities in their efforts to achieve cost-effective GHG emission reductions.

[45] This work is co-funded by the European Commission – see www.climate-compass.net/_project.html [last accessed 9 March 2009].

[46] http://www.theclimateregistry.org/resources/protocols/local-government-operations-protocol/

Table 8. Selected city-scale GHG inventory reports: comparison of key features

Basic Information[47]					Inventory			
City	Region	Population	Metro	ICLEI CCP	Data yr(s)	Indirect	City Operations Breakout	Protocol
Seattle	WA	573911	City limits	Yes	1990, 2005	Yes	Yes	GHG Protocol; IPCC National Guidelines
Vancouver	BC	2600000	Lower Fraser Valley	Yes	2005	No	N/A	IPCC National Guidelines
New York	NY	18815988	NYC Metropolitan Region	Yes	1995, 2000, 2005	Yes	Yes	CCAP ICLEI
San Diego	CA	1291700	City Limits	Yes	1990, 2004	Yes	Yes	n/a
Toronto	ON	2503281	City limits	Yes	2004	Yes	Yes	CCAP ICLEI
San Francisco	CA	7264667	County	Yes	2005	Yes	Only	CCAR
Columbia	MO	99174	City limits	Yes	2000, 2005	N/A	No	CCAP ICLEI
Northampton	MA	28978	City limits	Yes	2000	Yes	Yes	CCAP ICLEI
Palo Alto	CA	61200	City limits	No	2005	Yes	Only	CCAR
Sacramento	CA	475743	City limits	Yes	2004	Yes	Only	CCAR
Santa Barbara	CA	90400	City limits	No	2005	Yes	Only	CCAR
Somerville	MA	77478	City limits	Yes	1997, 1999	Yes	Yes	CCAR

[47] Sources: 2005 Inventory of Seattle Greenhouse Gas Emissions: Community and Corporate; 2005 Lower Fraser Valley Air Emissions Inventory and Forecast and Backcast; Inventory of New York City Greenhouse Gas Emissions; City of San Diego Greenhouse Gas Emission Inventory; Greenhouse Gases and Air Pollutants in the City of Toronto : Toward a Harmonized Strategy for Reducing Emissions; Annual Emission Report: City of San Francisco; City of Columbia Emissions Inventory; Executive Summary Greenhouse Gas Emissions Inventory Summer Internship, 2001 Cities for Climate Protection Campaign City of Northampton; Annual Emissions Report: City of Palo Alto; Annual Emissions Report: City of Sacramento; Annual Emissions Report: City of Santa Barbara; Greenhouse Gas Emissions Inventory Report: Including Recommendations for the Emissions Reduction Plan

Assessing regional and local impacts through sub-national science-policy exchange

A second priority for national-local collaboration is on science-policy capacity building and information. The aim of any such effort should be to establish a capacity to improve understanding about how climate change will affect cities. More detailed regional impact or risk assessments, in turn, could be expected to influence the politics of climate change from the global to the local scale (Harris 2001; Shackley and Deanwood 2002). Importantly, the assessment of climate impacts, vulnerability and risk at regional scale facilitates reflection about both adaptation and mitigation. That is, it supports dialogue and discussion about what types of risks are of greatest concern to affected populations and what adaptations might be most appropriate in local contexts, and it facilitates communication about what climate change is and why we need to do something about it to mitigate emissions (Corfee-Morlot, 2009).

Some amount of climate change is unavoidable no matter how much we mitigate. To understand and properly assess adaptation options, cities require information from scientific impact assessments to consider how climate change may play out in local contexts to impact people, urban settlements and infrastructure. What will the temperatures of the 2020s or 2030s be? How will flood risk change in the coming five years or more? And how will these climate changes interface with urban environments?

Climate science over the last decade or so has focused on large, global models that integrated different types of physical models to predict how the atmosphere will interact with oceans to change climate over time (IPCC, 2007). There is little regional information coming out of these science assessments so working at local or sub-national levels requires another layer of effort and a special set of tools to scale down or relate global change predictions to local or regional conditions (Hallegatte *et al.,* 2008). This can be done in a variety of different ways, but it takes time, expertise and money. It is research-oriented rather than policy-oriented work and organising funding and institutional capacity to make it happen in a timely manner can be difficult.

Establishing capacity to generate and use impact or risk assessment information at local or sub-national scale is a science policy exercise that presents a range of technical and procedural or institutional challenges.

On the technical issues, a recent OECD working paper proposes a framework to guide local scale impact assessment, including how global modelling results can be translated to a city scale as well as various issues in assessing climate impacts through use of a range of metrics (physical and monetary) and costs of responses under different conditions. In particular, it lays a conceptual approach to assess the avoided-impact benefits and the co-benefits of local adaptation and global mitigation (under different adaptation scenarios) (Hallegatte *et al.,* 2008). Moreover, two city case studies – Copenhagen (Hallegatte *et al.*, 2008) and Mumbai (OECD, 2009b) are being conducted to test and refine this framework.[48] Beyond providing original and detailed assessments of climate change impacts in these locations in the 2070s/2080s timeframes, these studies are also proving to be vehicles for engagement across key stakeholders in these locations. In particular, they are serving to stimulate dialogue among affected stakeholders across difficult questions such as what priorities to establish for adaptation investments given the range of possible outcomes surrounding uncertain climate projections (Hallegatte *et al.,* 2008). This highlights that procedural issues are also important, *i.e.* it is insufficient to have good scientific or technical analysis. To make good decisions requires active reflection and dialogue between expert and stakeholder communities.

[48] For more information on OECD work on cities and climate change, including links to this initiative from the Governance Directorate, please visit the website: www.oecd.org/env/cc/cities

On the procedural or institutional side, there is a need for active interaction between customers for information – policy makers and other decision makers – and the information suppliers, notably scientists and other experts (Stern and Fineberg, 1996). There are a number of examples featuring state-of-the-art deliberative processes to engage stakeholders from the start to shape the framings and findings of assessments. In Canada, for example, there is now some experience with regional (sub national) participatory integrated assessment to support watershed management and climate change adaptation decision making (Cohen *et al.,* 2004b; Vescovi *et al.,* 2007; Yin and Cohen 1994). An example of multi-lateral collaboration using deliberative methods exists in the recent assessment of the Arctic region. The Arctic Climate Impact Assessment was published in 2004 and, importantly, sponsored by the Arctic Council, which represents eight member-state governments (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States) and six permanent participants including two indigenous peoples' non-governmental organisations (ACIA, 2004).[49] This study was unique as it was both deliberative, employing a number of different methods to engage affected stakeholders, as well as an international process to facilitate deliberation among state actors with an interest in the region. More recently, the City of Los Angeles convened academic and environmental organisations to develop an outreach and public participation strategy for the City's Climate Program, which is based on over 150 stakeholder interviews with representatives of environmental organizations, financial institutions, business interests, media and movie industries, and youth groups (City of Los Angeles in OECD, 2009e).

Relatively recent policy driven scientific efforts to predict regional climate changes are also found at local and regional scales, for example, in the United Kingdom (McKenzie Hedger *et al.,*.2006; West and Gawith, 2005) and in the United States (Hayhoe *et al.,* 2004; Moser, 2005; Parson *et al.,* 2003). UKCIP works on a contract basis with different sub-national regions or local communities. Its main source of funding comes from the Department for Environment, Food and Rural Affairs as well as from other contributors including the Environmental Change Institute (Oxford University) and the Government's Knowledge Transfer Partnership scheme (UKCIP, 2005). Some of the results from the UKCIP suggest that cities provide a useful spatial scale for the stakeholder engagement in decision making. In the U.S., initial climate impact assessment was conducted through an extensive nationwide effort (NAST, 2000). This national process featured a broad-based consultative process to engage local stakeholders across different regions of the United States in the preparation and vetting of these reports (Moser, 2005; Parson *et al.,* 2003). Although the national process in the United States after 2000, with the change in administration under President George W. Bush, the regional networks of people who worked on these studies have continued to support regional impact assessments in state and/or non-governmental venues (*e.g.* in the case of California, see Corfee-Morlot, 2009).

Funding for such work will inevitably need to come from national governments, or relevant sub-national authorities, as it provides a public good that can be useful to stimulate adaptation across urban regions in an entire nation or region. Often the work can be carried out in local research centres or universities and joined up through "boundary organisations" to policy or other decision-makers. Again the lead time is long, often requiring nearly a decade to build significant expertise and competence in this area, hence the need to start today.

Table 9 highlights a number of different institutional models that have grown up in different places around the world to provide science policy support for impact analysis and adaptation policy decision making. In looking across the organisations studied, there is broad variation in their geographic scope and proximity to "local" clients, levels and sources of funding and key roles or functions of the organisation (see also Annex 2). However, there are also a number of common features. All of them focus on the same audience, aiming to engage business stakeholders, local governmental decision makers and other local

[49] See also www.amap.no/acia. It is interesting to note that the report stopped short of having powerful policy recommendations in part because of reluctant state actors.

citizens. Further, the organisations have various ways of interacting with the scientific community, acting either as consumers or as suppliers (by funding) of new scientific information. But they all target the same goal, which is to facilitate stakeholder and policy decision makers' access to and understanding of scientific information. Finally, all the institutions also target use of the local scientific community to contribute relevant information, working through local, regional and national universities, and other nationally or regionally supported research institutions.

Table 9. Institutional models for climate change information development and exchange

Organisation	Geographic Scope and Key Role	Clients/Audience	Interaction with Scientific Community	Source of Expertise	Lead Organisation	Core Funding
IRI - International Research Institute for Climate and Society	**Africa/Asia Pacific/Latin America** • Understanding local decision process; • Sharing climate information to meet the needs of the decision makers; • Linking institutions and build capacities to improve climate risks management; • Develop climate information generating tools that meet local decision makers' needs.	• Developing countries' national and multi-national decision makers • Developing countries' public/private sector • Developing countries' citizen	Suppliers	• Columbia University Depending on the region: • National/local Institutions • NGOs • Research centers	Host Institution: • University of Columbia Funders: Public and Private Sectors • NOAA Office of Global Problems • Several Organisations involved in project funding	Public/private $9M/Year
Ouranos	**North America/Canada/Québec** • Develop knowledge; • Co-ordinate multidisciplinary initiatives; • Help decision makers to integrated adaptation to climate change into their decision processes.	• Public and private sector decision makers • Local stakeholders • Researchers	Suppliers	• Federal agencies • Local and national universities • National research centers • Ouranos	Funders : Public and private sectors • Government of Quebec • Valorisation-Recherche Quebec • Hydro-Québec	Public/private $12M/Year
PIER-EA - Public Interest Energy Research, Environmental Area	**California/USA** • Conduct and fund research in the public interest; • Research the environmental effects of different energy technologies used in California; • Attract collaborators to share data and work conjointly to develop mitigation strategies; • Develop California's capability to make informed decisions on climate change mitigation.	• Californian decision makers • Private sector • Researchers	Suppliers	• Federal agencies • California State Agencies • Nonprofit groups and academic • Private laboratories	Host institution : • California Energy Commission Funders : Public • Charge on retail electricity sales	Public $6M/Year

Organisation	Geographic Scope and Key Role	Clients/Audience	Interaction with Scientific Community	Source of Expertise	Lead Organisation	Core Funding
UKCIP - United Kingdom Climate Impact Programme	**United Kingdom localities** • Communicate information on climate change impacts to stakeholders; • Provide policy-making tools to decision makers; • Establish relationships between researchers and decision makers.	• Local authorities, business, central government, voluntary organisations • Local stakeholders • Researchers	Consumers	• Oxford University Centre for the Environment • Tyndall Centre • Research groups within universities across the UK • Private laboratories	Host institution: • Oxford University Funders: Public & local resources • UK Department for Environment, Food and Rural Affairs • UK's Knowledge Transfer Partnership scheme	Public/private $1.25M/Year
Club ViTeCC - Villes, Territoires et Changement Climatique	**France** • Provide information to stakeholders, institutions and private sector on their roles in climate change adaptation; • Rethink the infrastructure-related decisionmaking process; • Make scientific and technical information understandable to local decision makers and developing the proper decision tools.	• Local and regional authorities, business sector • Private and public sector stakeholders	Consumers	• Private/public services • National meteorological center • National and international Universities • Known local and international experts	Host institution : • Caisse des Dépôts • Météo France • ONERC Funders : Private/public • Contributions from clients	Public/private N/A

Websites: http://portal.iri.columbia.edu/portal/server.pt; http://www.ouranos.ca/; http://www.climatechange.ca.gov/research/climate.html; http://www.ukcip.org.uk/; http://www.caissedesdepots.fr/spip.php?article647

Urban policy network and climate change

As mentioned before, local authorities cannot effectively address the massive challenges posed by climate change without the involvement of a wide range of non-public actors, including citizen's group, local NGOs and the business sector. In this respect, they contribute to policy networks formation that underlines the concept of multi-level governance at the horizontal scale. As Bulkeley and Bestill (2004), transnational networks of cities have also been essential in promoting policy learning and change among local actors and epitomize the multi-level nature of climate change governance contributing to global environmental governance.

The role of non-public actors in climate change

Civil society actors can broaden public participation in democratic structures and provide a voice for those who otherwise might not have a means to express their views. Civil society actors also tend to work on issues where there is a perceived gap in the work of governments. Conversely, they can also enhance and complement the work of governments. Although there is no formal role for non-state actors in international climate policy negotiations, transnational NGOs have played a role in filling in some of the adaptation gaps, both playing an important role in both assisting climate-affected communities now, while also working at the international level to promote adaptation policies and generate sources of funding for adaptation activities. In particular, civil society actors have been deepening their work with cities, by providing information clearinghouses, networking opportunities, model policies, and acting generally as coordinators of climate activities world-wide. Therefore, civil society actors have already carved out a role for themselves and an expansion of this work can be envisioned for the future, particularly efforts centred on adaptation. An early sign of this reconfiguration occurred in 1992 during the United Nations Conference on Environment and Development in Rio de Janeiro when 1,400 civil society representatives participated in the formal conference proceedings and another 17,000 people attended a parallel NGO Forum (McGann and Johnstone, 2005).

The strong turnout of civil society organisations in the recent UNFCC COP14 conference in Poznan illustrates the increasing participation of non-governmental organisations in climate change conferences, albeit much of it in side events. Indeed, Article 7, paragraph 6, of the United Nations Framework Convention on Climate Change allows for the admission of non-governmental organizations to sessions of the Convention bodies as observers.

Although many for-profit entities have now addressed climate change through corporate social responsibility activities and/or sustainability efforts, businesses have only just begun to take an active role to establish partnerships with local governments in the climate planning process. Firms have long been widely involved in the implementation process but not so much in the early stages of policy-making at the local and regional scales. The reason for this may be, in part, because although many cities around the world have established climate action plans that project the types of activities that will be needed in order to reduce GHG emissions and plan for adaptation, the implementation of these plans is still in the beginning stages.

Role of non-governmental actors in the local policy process stage framework

The involvement of the different local stakeholders is particularly important in the phases of agenda setting, policy formulation, implementation and dissemination of knowledge of the policy process stage framework.

(i) Agenda setting

Support from the business sector and general public provides an important driver and motivation in the agenda setting for climate change action plans and policies at the sub-national level. This support may take the form of a positive climate of public opinion or a lack of overt opposition from key interest groups.

Citizens' participation in local agenda-setting has taken different forms. At the global scale, the 1992 United Nations Conference on Environment and Development gave rise to Agenda 21 (LA21), which was an initiative that not only put "sustainability" front and centre, but also provides a strong basis for understanding local democratic participation and a, "community's right (whether the community be defined as indigenous, rural, local, or other) to participate in decision making processes at the local level is promoted through themes of inclusion, local knowledge, and, tentatively, empowerment and capacity building" (Summerville, 2008). Local authorities are the lead players charged with implementing the sustainability objectives of LA21, and have used a variety of models engaging public participation. These have ranged from individual projects to larger involvement, such as the European Commission Water Framework Directive, which requires active stakeholder involvement.

In elaborating their agenda, sub-national authorities have developed different participative methodologies to guarantee that climate policies are developed with input from different types local stakeholders. The formation of policy networks and research groups has been critical to launching a climate agenda in many cities. The City of Paris for instance established thematic working groups that were given the mandate to prepare policy recommendations which were synthesised in a white book presented in January 2007 to the Council of Paris that led to an Action Plan adopted the same year.

Aside from integrating input into climate change action plans, citizens may spur action through climate litigation. This strategy has the potential to produce immediate action, while also laying the groundwork for future policy action on climate change. Using climate litigation as a tool can have one or more of the following results: clarify existing laws, challenge corporate behaviour, assign responsibility, provide opportunities for seeking damage for climate-related injuries, stimulate and inform public debate and climate advocacy (Moser, 2007). For example in *Dieter Janecek v Friestaat Bayern (C-237/07 European Court of Justice 14 May 2007),* Dieter Janecek, a German Green Party member living near Munich's central ring road, complained to the local authorities that particulate levels had exceeded legal limits for more than the 35 days permitted under European standards. When his request to the local authorities to draw up a local action plan to address the problem was turned down, he took his case to the ECJ. In July 2008 the ECJ ruled that European citizens are entitled to demand air quality plans from local authorities in cases there EU limits may be exceeded. While no such case has been tried in relation to climate change, it is conceivable that in the future, citizens could try to hold cities responsible for implementing climate policies and programmes. Climate change litigation, originally inspired by class action environmental law suits, has inspired some governments and/or stakeholders to use courts to facilitate environmental improvements at local scale.[50]

(ii) Policy formulation.

As noted in the previous chapter, the formation of policy networks involving expert groups and commission, often organised on a sectoral-based, has been essential in the policy formulation stage.

[50] For example, the City of New York is part of a climate challenge against the federal government, specifically targeting the National Highway Traffic Safety Administration (NHTSA). This challenge criticizes the NHTSA's treatment and reclassification of CAFE (Corporate Auto Fuel Efficiency Standards), which incentivise the production of larger vehicles with lower fuel efficiency. Likewise, New York City has joined Connecticut and other states in a public nuisance challenge against five of the country's highest carbon-emitting power plants. This action is part of an effort to require these plants to gradually reduce their emissions, even in the absence of federally mandated standards.

The Climate Change Action Plan for the Northwest region of England for instance focused on the ability of regional organisations to "enable, encourage, and engage individuals, groups communities, partnerships and businesses in the move towards a low-carbon and well adapted region, recognising that regional organisations must exemplify good practice and catalyse action." It was developed with input from an advisory group consisting of experts and regional partner organisations. The consultation exercise included over 25 workshops and presentations and elicited over 130 responses from groups and stakeholders. Each action was tied to a lead organisation responsible for defining detailed steps required to deliver the action. To ensure long-term political support and focus, Guelph, Ontario, relied on working groups led by current and former mayors and council members with ex-officio roles to co-ordinate the planning of the town's community energy plan.

A wide number of climate change planning efforts are underway to involve the private sector in climate change action planning. For example, in 2008, the Mayor of New York City announced the formation of a Climate Change Adaptation Task Force for the City, which is advised by the New York City Panel on Climate Change. This is comprised of leading experts from regional academic institutions and the legal, engineering, and insurance industries. The task force is one of the world's first municipal efforts to address climate change adaptation that includes participation of businesses alongside government, as can be seen below.

In most cases, the adoption of climate change action plan would not have been possible without the mobilisation of representatives of the business and community organisations. In Los Angeles, the plan adopted in 2007 received support from the coalition Green LA consisting of over 60 environmental and community-based organisations focussing on climate change (Bulkeley and Schroeder, 2008). It has also been supported by a large segment of the business community which were engaged in promoting green business solutions.

(iii) Implementation.

Implementation cannot simply happen with the involvement of non-public actors. London's approach has been explicitly based on partnerships with the private sector, *e.g.* the London Climate Change Partnership, the London Hydrogen Partnership, and the London Energy Partnership. In the U.S., more than 50 private firms are taking part in the ClimateWise Program, in which cities offer free assessment of a firm's energy, water, solid waste, transport, and recycling, and then offer guidance on becoming more efficient. The City of Chicago allocates grants for rooftop gardens and Seattle launched a programme in which businesses assess and cut their GHG.

(iv) Dissemination of ideas and best practices

Many of the best policy ideas are disseminated replicated elsewhere and might even inform a change in the original policy itself. However, many other useful policies live and die within a city's borders, although they may present useful solutions for other local governments. Although this stage is not a central component of the policy process, and may arise unexpectedly, it can be an important outcome of the local policy process, as it can inform future agenda setting and actions beyond the city or local boundaries. Civil society organizations, including industry associations, may play a key role in collecting and sharing information on climate change policy design and implementation.

A wide number of professional associations have issued guidebooks and designed training seminars to prepare urban managers to design more climate-sensitive cities. For example, the American Planning Association now includes climate change materials alongside other policy initiatives highlighted on its website, with the adoption of a new Policy Guide on Planning and Climate Change (April 27, 2008). Recently (January 2009), APA released a memo that provides an overview of the ways in which energy and climate can be integrated into planning, and appears to be a document to that will launch some future

work of this nature. Currently, the APA's website does now serve as a repository for information about state and local climate change initiatives, and a climate change reader for members is also available. Likewise, the *U.S. Green Building Council*, a non-profit membership organization, has provided technical education to its membership organisations. It currently has a comprehensive family of LEED® green building certification systems, educational programming, and a network of 78 chapters, affiliates, and organizing groups. A wide number of initiatives in professional engineering, waste management, accounting, and public administration associations follow such initiatives.

Trans-border regional cooperation and international networks of cities

Transnational networks of local governments have formed to share strategies for combating climate change and building climate resilience in cities and regions. These networks are comprised of actors and/or institutions operating across multiple scales that involve, "regular interaction across national boundaries what at least one actor is a non-state agent or does not operate on behalf of national government or intergovernmental organization" (Risse-Kappen, 1995). Many regions have co-operated on the transnational level to exchange policy approaches and metrics. In 1999, the Northern Virginia Regional Commission and the Verband Region Stuttgart initiated an international partnership and exchange. Numerous planning practices have diffused from Germany to Virginia through the partnership, including solar energy, storm water, transportation and open space planning policies.[51] In 2008, the partnership expanded its focus to include over 80 other European and North American regional councils, co-ordinated under the umbrella of the European Network of Metropolitan Regions and Areas. The partnership is unique in its problem-focused and goal-oriented efforts to identify, review, and apply innovative climate mitigation and adaptation policies among regions in Europe and the United States.[52]

The sustainability movement of the 1990s prompted the development of many large transnational networks of cities working for sustainability. From 1982 to 2004, there was a spike in the number of sustainability-related city networks, rising from 8 to 49 (Keiner and Kim, 2006). Box 7 profiles the climate change activities of some of the most important city networks.[53] National and transnational networks have been crucial in sharing experience, strengthening capacity-building, developing standardised methodologies and integrating cities' opinions at national and international levels. International networks of cities play a crucial role in enhancing a learning process that has resulted in the dissemination of best-practice methodologies and tools that can assist local governments to develop GHG-reduction strategies. This co-operation has produced a rich exchange of information on urban design, zoning, street patterns and public transportation that has been mirrored at the transnational level.

[51] Dale Medearis and Brian Swett, "International Best Practice and Innovation: Strategically Harvesting Environmental Lessons from Abroad," *Ecologica*, October 2003.

[52] See the Network of European Metropolitan Regions and Areas (METREX) web site for more information, (www.eurometrex.org).

[53] Other organisations include The Climate Group **(**www.theclimategroup.org**),** World Mayors Council on Climate Change (www.iclei.org/index.php?id=7225), The World Mayors and Local Governments Climate Protection Agreement (www.globalclimateagreement.org/index.php?id=7462), Covenant of Mayors (www.eumayors.eu/covenant_cities/towns_cities_en.htm), Mayors Climate Protection Center (www.usmayors.org/climateprotection/list.asp), Sustainable Cities: Partners in Long Term Urban Sustainability (PLUS) Network (sustainablecities.net/), Cities Development Initiative for Asia (www.cdia.asia/about), Asian Cities Climate Change Resilience Network (www.rockfound.org/initiatives/climate/acccrn.shtml#4), Oslo-Denver-Initiative (www.ceunet.de/oslo_denver_initiative.html), and Global Legislators Organization for a Better Environment (www.globeinternational.org).

Box 7. Transnational Networks of Cities Addressing Climate Change

- ICLEI or Local Governments for Sustainability is an international coalition of local governments committed to advancing climate protection and sustainable development. Originally named the International Council for Local Environmental Initiatives, ICLEI was founded in 1990 and now boasts membership of close to 1,000 cities worldwide, more than half of which are located in the United States. To help members achieve tangible reductions in greenhouse gas emissions and environmental impacts, ICLEI provides: tools, technical expertise, software training, policy assistance and national and international peer networks. ICLEI promotes a climate change planning process based on five milestones: calculating emissions, adopting targets, developing policies, implementing measures, and monitoring results. The organisation works through the Cities for Climate Protection (CCP) program, which emerged as a network of local governments engaged in the international climate dialogue. When it was first founded in 1993, CCP was focused on developing energy and emissions inventory, and evolved to include establishing and implementing GHG emission reduction targets for cities. Today, CCP acts as the enabling mechanism for the U.S. Mayors Climate Protection Agreement and constitutes a network of over 700 local governments (ICLEI, 2009; Lindseth 2003).

- *Clinton Climate Initiative (CCI) and the Large Cities Climate Leadership Group (C40)* The Clinton Climate Initiative was launched in August 2006, and is currently working with 40 of the world's largest cities to reduce their GHG emissions (Clinton Foundation 2009). CCI works closely with the C40 Large Cities Climate Leadership Group, serving as the exclusive implementing body of C40 works. Pledged to reduce carbon emissions and increase energy efficiency in large cities across the world, the C-40 forum brings together four of the world's largest energy service companies, some of the world's largest banks, and at least 15 of the world's largest cities, to reduce energy consumption in existing buildings.[54] This means that CCI works with partner cities to, "develop and implement large scale projects to improve energy efficiency and directly reduce greenhouse gas emissions in buildings, waste management, transportation, outdoor lighting, ports, and other areas" (Clinton Foundation, 2009). From Seoul to Johannesburg it helps the largest cities in the world retrofit their municipal buildings, public housing and commercial buildings.

- *UCLG (United Cities and Local Governments)* UCLG is a transnational network comprised of individual cities and national associations of local governments which in total represent over half of the world's total population. Subsequently, more than 1000 cities in 95 countries are direct members of UCLG, along with 112 Local Government Associations (LGAs). UCLG aims to be "the united voice and world advocate of democratic local self-government, promoting its values, objectives and interests, through cooperation between local governments, and within the wider international community" (UNLG, 2009). To that end, this network has taken an active role in climate change, having recently adopted the World Mayors and Local Governments Climate Protection agreement.

- *The EUROCITIES* network was founded in 1986, and now includes the local governments of more than 130 large cities in over 30 European countries. The network is poised to provide a voice for cities in EU governance structures through engagement in dialogues with the European institutions on all aspects of EU legislation, policies and programmes that affect cities. It is designed, according to one former EUROCITIES official, so that cities should "overcome their overt competitiveness" and make efforts to speak with "one voice" in order to put "more pressure on national and European institutions" (quoted in Heinz, 2005). In June of 2008, the mayors and leaders of EUROCITIES released a "Declaration on Climate Change." This document reflects the organisation's commitment to fighting climate change, and provides a framework for cities to adopt climate action plans, which are part of the suggested 3-prong strategy. Guidelines for these climate action plans range from planning to reduce sprawl and increase green spaces to investing in the development of renewable energy production. Another piece of the EUROCITIES approach, as outlined in the declaration, includes integrating the concepts of the prevailing global objectives, based on input from the scientific and international policy negotiation communities, into their climate work. The third piece of the EUROCITIES approach involves measuring and reporting on GHG reductions to access the success of the climate action plans.

[54] C40 was founded when a group of 18 international cities met in London in 2005 to discuss collaborating to tackle climate change. The outcome of this meeting including a more formalised pledge that recognised the role and responsibility cities have in addressing climate change.

Beyond dissemination and best practice sharing, the transnational networks of cities have been increasingly active in the global agenda for climate change. Sub-national governments have mobilized internationally to develop/influence numerous bilateral and multilateral arrangements, which culminated in December 2007 with the launching of The World Mayors and Local Governments Climate Protection Agreement at the United Nations Climate Change Conference in Bali and the Local Government Climate Roadmap. Organisations participating in the Climate Roadmap process include the following partners: ICLEI, UCLG (United Cities and Local Governments), Metropolis, WMCCC (World Mayors Council on Climate Change), and C40 (Climate Leadership group). The Local Government Climate Roadmap process shadows the meetings and timetable of the UN process, and local governments have been capitalising on the momentum leading to Copenhagen to deliver their messages about local climate action. Overall, the association of local governments' networks calls for greater recognition of the cities in the next UN Framework Convention on Climate Change (UNFCC) framework. One desired outcome of this process is to politically influence climate negations during the United Nations negotiation process leading to COP 15 and a post-2012 climate agreement (ICLEI, 2009).[55]

Though transnational networks seem to capitalise on the theory that higher membership rates correspond to increased bargaining power, the political benefits of these networks remain unclear. There appears to be much overlap in the types of activities that many networks are involved in, with many of the same municipal players (cities) involved in multiple initiatives. Although many key networks have come together through the Roadmap process, it is unclear to what extent these organisations are otherwise co-ordinated. Some observers have even argued that local governments have been compelled to join the CCP not only for the access to information that membership provides, but also because of the financial and political resources it affords (Betsill and Bulkely, 2004).

Summary points

Understanding climate change in a local context can highlight opportunities to maximise local benefits of mitigation and adaptation action. This will also make the issue of climate change more tractable politically. As a key tool for decision making at local scales is an exchange that allows for an interface between experts and local stakeholders, including local government, to build understanding about how climate change may affect local development choices and how those choices will affect the future climate. This is referred to here as an analytic-deliberative exchange.

This section calls for national governments to work with local authorities to develop tools and opportunities to use an analytic-deliberative process for decision making on climate change. A first step towards enhanced multilevel governance could include the development of better urban GHG inventory tools and capacity for local science-policy assessments. On the first suggestion, better tools for comparable emission reporting and performance assessment could expand opportunities to assess progress and learn from urban scale action, to share experience and lessons from city mitigation efforts. Making city GHG inventories comparable will require higher level agreement (i.e. ideally at international level) on a common format for reporting as well as on key methodological issues. Consensus will be needed on how to treat key issues such as those outlined above in a consistent manner. Even if cities are given the flexibility to construct inventories with different boundaries (*e.g.* in terms of reporting direct and indirect GHG emissions), at a minimum it will be necessary to report these in a modular manner such that comparable estimates could be constructed. Due to the high costs associated with increasing the quality of data necessary to produce strong, comparable emission inventories, it will most likely be necessary to find a

[55] Recently during the United Nations Climate Change Conference in Poznan, Poland, (COP 14) local government representatives from ICLEI presented the Local Government Climate Roadmap to United Nations officials, which included a draft text of a COP Decision on Cities, Local Authorities and Climate Change was presented by local governments to the signatories to the Kyoto Protocol.

middle ground, with enough detail to remain useful, but not so onerous as to make its production burdensome or financially unfeasible for local budgets. Ultimately a stronger urban inventories tool will allow cities better access to international carbon markets as a possible source of financing for local action.

A second multilevel governance priority is for national government support to local decision making through development of analytic-deliberative capacity at local scale to generate and use scale-relevant scientific information on impacts of climate change, and other policy-relevant research (i.e. on the technical options to adapt or mitigate and their costs). This will necessarily be part of an iterative process engaging researchers and stakeholders in an ongoing exchange. Beyond engaging relevant participants, a first task is to establish a discursive process that allows ongoing exchange so that core research questions are framed with input from decision makers and decisions are made in local contexts based on the best available information from the scientific and research community. Up-to-date information on climate change impacts provides a foundation for communication about climate change with stakeholders and a means to generate understanding and concern about the issue as well as support for policy reform and behavioural change to respond. It is a means to bring the abstract and distant problem of climate change into a local context and help people – investors and consumers alike – to relate it to their daily lives so that they can think about how to address it. It provides at once a motivation for mitigation and a powerful source of information for decisions on adaptation.

A third priority is for national governments is to encourage better development of urban policy networks, and in particular the engagement of regional and local non-governmental stakeholders at various stages of the policy process to deepen knowledge, formulate and implement strategies for mitigation and adaptation that resonate from the bottom up. This will help local authorities to shape social norms through reflection about different possible urban forms and their interface with climate change. In particular, it provides a vehicle to more carefully adjust and align local frameworks to move in the right direction so that they identify where perverse incentives exist and suggest how they might be reformed. The aim is to allow for more systemic changes in urban planning and development and incentivise technology as well as behavioural change to build climate resilient, low-carbon economic growth. Strengthening inter-regional/urban and transnational policy networks might also be encouraged as another means to assist with identification and dissemination of good practice.

6. CONCLUSIONS

Climate change is a problem that can only be adequately addressed if action is taken at all levels of government: international, national, regional, and local. Cities may be uniquely well placed to help deliver on the promise of climate protection. In particular, cities have the ability to design solutions that are adapted to the needs of local constituents and that are consistent with local policy priorities. City or local authorities also have distinct mandates and jurisdictions from national governments in some areas that are key to the design and implementation of climate change responses, such as land use planning and zoning, water and waste management. As a result, local authorities have a unique possibility to reform pre-existing local policies and practices to integrate adaptation to expected climate impacts and to mitigate emissions in a cost-effective and timely manner. Finally, urban and regional governance of climate change may provide an opportunity to experiment and learn about innovative solutions at relatively small-scale (*e.g.* the use of a congestion charge in London versus bus-lanes in Paris). These features of city-scale action on climate change lend support for strengthened multi-scalar national policy frameworks which further exploit some of the advantages of designing and implementing climate change policy at city scale.

National policies and progress to mitigate or adapt is intertwined with local action to address climate change. On the one hand, local action and experience can inform national policy. Equally, progress at national scale to reduce GHG emissions (*i.e.* to mitigate) and to limit impacts (*i.e.* to adapt) will be dependent on a large number of actions that play out in various ways at local scale. On the other hand, national governments can work hand-in-hand with local governments to require and encourage the development of locally tailored policy and voluntary action. The capacity of local governments and institutions is ultimately shaped by national law and policy and dependent upon the nested institutional structures of any particular national context.

Policy implications of multilevel climate change governance

Despite a diversity of experience, some general observations about "good practice" in multilevel governance emerge from this review:

- ***First, national policies are a central enabler of local action on climate change adaptation and mitigation.*** To avoid a patchwork of uncoordinated targets, goals, and programmes, national governments can and should take the lead with design and implementation of broad cross-cutting instruments, such as those designed to put a price on carbon (*e.g.* carbon taxes or cap and trade systems) or with the establishment of national performance standards. National policies may also advertently or inadvertently constrain the ability of local authorities to act by not devolving authority on key issues, *e.g.* on transport infrastructure or specifications for urban public infrastructure. Where authority is devolved there is a need to ensure the availability of financial resources and capacity to address climate change in a timely, economic and environmentally effective way. Delivering stable financing for local action may be straightforward, for example, by ensuring that there is a sound local tax base on which to draw necessary financing or, alternatively, through financial support from the national tax base. While there are many examples of cities and regions that are starting to act, there are even more examples of cities and regions that have not yet appreciated the serious need for immediate action. There is thus a need for specificity in the design of national policies to enable action at sub-national scales to fully integrate climate consideration into regional and urban development strategies.

- ***Second, there is significantly greater potential for experimentation at local scales, which in turn can be a testing ground for national governments.*** Where successful, such experiments can provide an essential evidence base to support development at broader scales of new forms of policy. At a minimum, it opens the possibilities for broader diffusion in other urban areas, but also possibly nationally or even internationally. Such experience may also shift the politics of climate change, by demonstrating what is possible and at what cost as well as by demarcating clearly who wins and who loses from the actions taken. As most national governments struggle to achieve ambitious mitigation targets and to put adaptation plans in place, such experience can inform and eventually lead to broader scale action. Thus, a key aim of national policy may usefully be to encourage, enable and possibly finance experimentation that goes above and beyond the parameters of nation-wide solutions. In this way urban policy can be a testing ground for broader scale efforts.

- ***Third, close collaboration between local and national authorities to build capacity on the climate change issue will improve the chances to exploit potential for cost-effective mitigation and adaptation to climate change.*** Indeed some of this potential is available through local action, for example, by integrating understanding about climate change risks into local land use and zoning practices. This may include attention to heightened flood risk due to sea level rise and storm surge in coastal zones or changing precipitation patterns. Climate change may also require changes in local water management, responding to increased needs for drainage capacity in city streets, and improved management to anticipate shifts in demand, availability and possibly quality of water. Similarly demand side management for water and energy use may be most usefully advanced through local programmes. Responses to these types of problems may best be in the hands of city managers, however, to be effective on the climate change front they will need the proper resources to anticipate and address these risks.

- ***Fourth, some effective cross-sectoral regional or urban development strategies appear to be driven by the climate change imperative, where climate change mitigation and adaptation is seen to be a potential source of regional economic development.*** By contrast, strategies based on adding a "green" component in a more isolated manner to sectoral regional development policy drivers (for example, infrastructure development), seem less likely to successfully sustain regional economic development and tackle climate change over the longer term. This is potentially a "paradigm shift" moving away from perceiving growth and sustainability as an either/or proposition to defining the two policy objectives as linked and mutually reinforcing. It assumes that national governments identify and exploit synergies, and work to address trade-offs economic development where they exist.

Some principles for good practice are more easily advanced at lower rather than higher levels of governance, or at least require the engagement of local authorities to ensure delivery and effectiveness (Table 10). For example, the engagement of local governments may democratise and increase citizen engagement in climate change activities. City authorities are in a unique position to engage local stakeholders and design locally tailored responses to climate change. They may also be better situated than national governments to confront many of the difficult challenges related to adaptation, including managing flood risk, water stress, or the "climate proofing" of urban infrastructure. With respect to mitigation, local authorities may be better placed than national governments to reduce GHG emissions from some key sources such as waste and transport, and deliver a range of co-benefits to local citizens. They can be supported by specific central government policies for experimenting with innovative solutions that could, if they provide good results, be implemented in other places. Urban and territorial development policies may also offer particular opportunities to address climate change. Strengthening multilevel governance approaches is therefore key to delivering both low-carbon and climate-resilient development in the future.

Table 10. National versus local strengths putting principles of good governance into practice

Principle of good governance	Local / regional or Smaller scale	National or Higher level
Ensure participatory governance and strategic planning	✓✓	✓
Provide an analytical foundation for short and long-term planning	✓	✓✓
Deliver cost-effectiveness and economic efficiency	✓	✓✓
Encourage experimentation and innovation	✓✓	✓
Address distributional consequences and procedural equity	✓✓	✓
Establish a long-term planning horizon	✓	✓✓
Deliver policy coherence	✓	✓
Conduct monitoring, reporting and evaluation	✓	✓

Towards a new climate change governance paradigm

Despite a flurry of recent activity in cities on climate change and growing interest in the research community, climate policy at city-scale remains fragmented and the basic tools to facilitate good decision making are still lacking. Local governments are confronted by numerous barriers that can inhibit their agenda setting and implementation abilities. These include financial, technical, capacity, informational, and institutional governance obstacles, among others. When it comes to climate and energy, the policy landscape is full of sub-national governments unable to tie quantifiable mitigation targets with large-scale applications of energy efficient buildings, building retrofits, renewable energies, and transit-oriented development. Enhancing climate change policy capacity in local contexts, in turn, will bring experience and political support for action, local know-how and ideas, as well as experimentation and experience on how to address climate change to the table.

National governments have the opportunity to help or to hinder city competence on climate change. Local and regional governments often are able to address the problems that are within their jurisdictional powers by introducing solutions for which they are legally and financially capable of supporting. Yet, often local governments are not provided with sufficient support from intermediate and national levels of government to perform at their fullest or to implement what is expected of them. Working with sub-national and national governments, as well as with the international community on the development of a number of tools could assist cities to be more effective. Relevant tools or support mechanisms include:

- **harmonised GHG emission inventory and reporting** protocols for cities to allow them to monitor and compare progress in mitigating emissions, to assess cost-effectiveness of additional mitigation options and eventually to become active participants in international carbon markets;

- **regional impact science and other policy relevant research programmes** to support the interface between expert information and local knowledge and promote local understanding of climate change risk and policy options – from assessment to management -- for better mitigation and adaptation decision making; and

- **urban climate policy networks,** building on regular channels of communication among national planners and regional and local government officials as well as among local stakeholders and decision-makers about targets, goals, strategies, and measures. An appropriate response to climate change needs to transcend a government-policy based approach to embrace governance mechanisms that harness the creativity and advice of civil society, from business and academia to community leaders. These are essential not only to enrich the policy development and implementation process but to optimize transparency in accountability and reporting.

While the agenda for multilevel governance of climate change is undoubtedly much broader than this, developing tools in these three areas could move the climate change governance agenda forward. National enabling frameworks will be essential to support cities to design and deliver cost-effective policies to address climate change action plans, but will need to resolve jurisdictional overlaps and questions of concurrent mandates. National governments may need to work closely with the international community to ensure that there is legitimate policy space for cities to participate, especially in market mechanisms for a post-2012 agreement. These are enabling activities that if tackled today could carry cities forward to deliver on the promise of climate protection over decades to come.

In terms of *vertical* collaboration, there is a need for additional dialogue and exchange of information, *e.g.* integrated across levels of government within country, where exchange of ideas and information about goals, policies, measures, problems, and successes can be exchanged. There is also need for further monitoring and assessment about the performance of different approaches to better linking policies and building on experience across levels of governance.

Regarding *horizontal* co-operation, insufficient global attention has been placed on the horizontal linkages and communication among local and regional governments. Unfortunately, actions often remain individual and uncoordinated. The use of horizontal networks to search for and test innovative climate policies remains *ad hoc*, rather than problem-focused and goal-oriented. To improve effectiveness, national, regional and urban authorities will need to design territorial-based approaches to limit climate change, which integrate risk management strategies and mainstream the consideration of climate change mitigation and adaptation in spatial development policy at all levels.

Recommendations and possible future work

As climate change becomes an increasingly important policy driver for regional and urban economic development policies, a robust quantitative, evidence base is required to inform sound public policy development and implementation. Currently, large information gaps remain related to inter-jurisdictional comparability, common indicators and metrics to measure progress. Front and centre is the need for an evidence base to enhance the ability to identify and diffuse best practices, not only at local scale but also in terms of how national and local government partners can work better together. Strengthening empirical evidence – including through improved local inventories of GHG emissions -- will advance understanding about where climate change regional and urban development practices are performing well and why, and about how national policy frameworks enable or constrain performance at sub-national scales.

The OECD can play a key role in developing the evidence base required to inform public policy development and implementation in this area as well as in providing a forum for the sharing of good practice.

ANNEX A: EXAMPLES OF MULTI-LEVEL GOVERNANCE LINKING IN CLIMATE POLICY

Multilevel governance in China: voluntary agreements

China is the biggest CO2 emitter in the world (IEA 2007) (Eichhorst, Bongardt 2009). Economical problems related to climate change prompted the Chinese government to put energy efficiency at the top of their agenda. In 2007, the World Bank estimated that the cost of inaction to China's economy (i.e. health, energy efficiency, and building degradation) totalled around US$100 billion annually, or 5.8% of China's GDP (World Bank 2007). China is rapidly urbanizing, having reached an urbanization rate of 35% in 2000. Although coal heating systems are gradually pushed back in major Chinese cities, vehicle emissions are becoming the biggest sources of urban emissions. In Beijing alone, air pollution have become one of the leading causes of deaths and its cost is estimated from 7.5% to 15% of the city's GDP (Creutzig, He 2009). China's 11th Five Year Plan, 2006–2010 sets a target for energy intensity reduction. Structural problems however make implementation at the local level difficult, as Chinese implementation of top-down policies is typically very weak (Teng, Gu 2007). The National Climate Change Policy Coordinating Committee is an inter-ministerial committee that is responsible for policies addressing climate change and the division of labour between national and local level of the organization is difficult to establish. Moreover, laws are formulated in a way to let local administrations interpret them to their own advantage.

China's central government is aware of the need for regional governance in climate change. It has recently signed contracts on energy efficiency and pollution reduction targets with provincial level officials and is currently looking for a new approach in the energy sector (Yuan 2007). The central government's new preoccupation with environmental issues, combined with the annual performance review of the local leaders, may provide a means for the central government to put additional pressure on local and regional governments to achieve local emission reductions and increase energy efficiency. The central government is now looking at voluntary agreements as a substitute for top-down policies (Yuan 2007).

The city of Nanjing is one of the most developed cities of China and has been referred to as the "Chinese Environmental Model City". Like every other Chinese city, it has a local Environmental Protection Bureau (EPB) responsible for implementation of national energy, environmental and climate policies at local level (Teng, Gu 2007). Local administrations elect the director of their local EPB while they focus on economic development (Teng, Gu 2007). Jointly with the European Union, Nanjing Environmental Protection Bureau (EPB) launched a voluntary agreement program with local state-owned companies[56]. The city developed and demonstrated with the funding from the European Union in the Building and technology sectors a model for voluntary agreements for local governments. Since 2002, the Asia Pro-Eco Programme has been funded EU and Asian organisations to improve environmental management in China in the project called "Feasibility Study on Demonstrating Voluntary Approaches for Industrial Environmental Management in China". From 2002 to 2006, 53 million Euros were invested (European Commission 2009). In March 2008, a voluntary agreement was signed between Nanjing Environmental Protection Office and targeted companies. These agreements included a 5% reduction of emission intensity of between 2007 and 2009 (Yuan 2007).

[56] The entire power sector in China is state-owned.

Each company involved in a voluntary agreement is establishing a team responsible for analysing energy efficiency potentials, implementation and internal monitoring, as well as interaction with Nanjing EPB (Yuan 2007). Incentives were also provided to participating companies. Grants were largely supported by Nanjing EPB through revenues generated by a pollution tax (Yuan 2007).

Multilevel governance in Japan

In 2005, the national government introduced the Kyoto Protocol Target Achievement Plan, revised in 2008. It focuses on low carbon levels in municipal and regional areas and encourages the use of JI and CDM (Government of Japan 2008). With this plan, the Japanese government aimed at stimulating municipal and regional initiatives in the energy efficiency, transport and regional planning sectors (Government of Japan 2008). Further, Japan's Global Warming Law was designed for local and regional governments to put climate change actions and policies in place. Althought environmental and energy policies are considered to be national government competencies; national government can delegate its authority to governors and mayors to implement national laws. Moreover, regional and local governments can develop their own policies and measures whenever the central government does not act in the climate change sector (Sujiyama, Takeuchi 2008). Throughout Japan, local and regional governments implement and monitor their own climate action plan. Monitoring of municipal plans is often done by monitoring groups which include local stakeholders and decision makers (Sujiyama, Takeuchi 2008).

Several Japanese examples also exist where regional and local governments take the lead in climate change regulations and policies. Specifically, some prefectures and cities in Japan are now acting as regulators in climate change mitigation. It is the case for Kyoto and Tokyo. Kyoto introduced a Global warming ordinance in April 2004 proposing a 10% GHG reduction from 1990 level by 2010. In 2000, household and energy use were accountable for 23% of all the municipal ghg emissions in Kyoto (Kyoto Local Agenda 21). The city of Kyoto regulated on a labelling system informing consumers about the environmental impact of their air conditioning appliances and televisions. Studies suggested that these labels were motivating consumers to purchase efficient appliances and that the labelling system had an efficiency improvement on air conditioners purchased in 2003 (Japan for Sustainability). This led to a national amendment and to a national energy efficiency labelling system in 2008. The national guidelines for environmental labelling require Japanese businesses to provide environmental information for other businesses and consumers (Ministry of Environment 2008).

Tokyo, the world's largest city, is responsible for administering a jurisdiction of 12 million inhabitants. Many of the city's mitigation measures were designed to meet emissions targets imposed by cities themselves (World Bank 2009). In 2007, the city of Tokyo took the lead in regulating municipal emissions by introducing the first[57] mandatory cap and trade system in Japan as part of its climate change strategy[58] (City of Tokyo 2008). Even though the national government discussed the issue of introducing a national emission trading system (ETS), it was never introduced at the national level because of the strong pressure from national industries (Sujiyama, Takeuchi 2008). Starting on 2010, the Tokyo cap and trade system will target 1255 private organizations from the industrial and commercial sectors. Office buildings, factories, department stores, hospitals and hotels are covered by the Tokyo ETS which is the first ETS in the world to target such companies (Tokyo Metropolitan Government 2007). The ETS cap will be establish according to Tokyo's own emission reduction target, a 25% reduction by 2020 from the 2000 level (Tokyo Metropolitan Government 2007). Tokyo ETS was approved by business groups, companies, NGOs and

[57] Japan Voluntary Emissions Trading scheme (JVETS) was the first to establish carbon pricing and trading in Japan.

[58] The Tokyo Climate Change Strategy aims at reducing Tokyo's ghg emission from the 2000 by 25% by 2020. http://www.kankyo.metro.tokyo.jp/kouhou/english/pdf/TOKYO%20Climate%20Change%20Strategy%202007.6.1.pdf

Tokyo's Chamber of Commerce and Industry during a vast public consultation (City of Tokyo 2008). Monitoring and reporting will be done every year. Important lessons can be learned from Tokyo's experience in climate action, particularly in the city's engagement with stakeholders (i.e. the time taken by local administration to form and explain proposed measures, receive feedback and gain project acceptance, creation of a mechanism that oblige or encourage stakeholders to engage climate action) and partnering with private firms and developing joint initiatives (World Bank 2009).

Other local governments develop their own actions in the promotion of energy efficiency. Osaka, Wakayama and Ube are among cities operating "fifty-fifty" programs jointly with public schools and energy service companies. In this type of programme, public schools receive a subsidy equal to half of the money they have saved by reducing their consumption of electricity, fuel and water (Sujiyama, Takeuchi 2008). For example, Ube city promotes a fifty-fifty program calculated on the basis of the city's budget for these costs over the previous two years. In 2007, local schools saved about 8.8 million yen, meaning a total subsidy of 4.4 million yen were paid from the city budget (Japan for Sustainability). Other local governments provide subsidies for the installation of energy efficient equipment. The city of Kyushu in the Saga prefecture promotes a program for photovoltaic electricity and pays 40 yen per kilowatt/hour to the producers (Japan for Sustainability).

Multilevel governance in Finland

In Finland, the responsibility for climate change policy is shared across the most relevant government ministries. Although the institutional model is top-down, local governments are also active. The Long Term Climate and Energy Strategy is under the responsibility of the Ministerial Working Group on Climate Change and Energy, headed by the Ministry of Employment and the Economy (Government of Finland 2006). The Ministry of Employment and the Economy also plays an important role in the domestic climate policy issues. The Ministry of Transport and Communications and the Ministry of Agriculture and Forestry are both in charge of climate change related decisions in their own field. The Ministry of the Environment is responsible for the environmental policy issues, building codes, and regional planning. The Finnish Environment Institute monitors and assesses regulation implementation and provides information on GHG emissions and other aspects of policy performance to the public (Monni, Raes 2008). The Environment Institute is also managing a climate change mitigation program to ensure that economic actors as well as citizens are aware of the latest research (Finnish Environment Institute (SKYKE) 2009).

Further, two complementary national public-private organisations are developing knowledge on climate change and sharing the information with stakeholders, industries and decision makers: Motiva Oy is a non-profit company funded and directed by the Ministry of Employment and the Economy. It provides information on the impact of energy conservation and renewable energy sources to energy users from the industry, commercial, public and households sectors (Motiva Oy 2008b). Motiva Oy commercializes and communicates products that improve energy efficiency and supports energy efficiency agreements implementation (Motiva Oy 2008a). In 2007, Motiva Oy turned over 4 million Euros to the Ministry of Employment and the Economy (66%) as well as to other Ministries (12%) and public administrations (9%) (Motiva Oy 2008a). TEKES is the National Technology Agency in Finland. It is the main source of public financing for clean technology innovation and is also an expert organisation that conducts research on innovation (TEKES 2008). TEKES partners with the business community and researchers to develop and finance industrial R&D projects as well as projects in universities and research institutes in the area of climate-friendly technology. TEKES funds come from the Ministry of Employment and the Economy and from companies developing their own project in partnership with universities. They were estimated at EUR 516 million in 2008 (TEKES 2008, Tekes 2009). Euro 60-80 were invested in climate change related technologies and R&D (Tekes 2009).

Regional Environment Centres (RECs) and permit authorities, have an important role in the regional/sub-national collection of information on environmental issues. They are also involved in land use planning, environmental education and campaigns to reduce greenhouse gas emissions (Ministry of the Environment 2009). Jointly with permit authorities, the thirteen RECs make decisions on environmental permits for large and medium-sized enterprises. Their mission and goals are defined by the Ministry of the Environment. However, RECs also prepare regional programmes providing guidance on environmental and land use planning (Ministry of the Environment 2009). These are voluntary guidelines for cities to follow and they are influencing how cities are addressing the issue of climate change.

The Association of Finnish Local and Regional Authorities (AFLRA) provides lobbying services, research and development services and other expert services for local authorities (Local and Regional Government Finland 2008). Its priorities are mainly focussed on municipal management and local democracy. With regards to climate change, the AFLRA is active in the promotion of energy saving and the use of sustainable energy (AFLRA). It is funded by contributions from the members (i.e. Finnish cities) annual membership fee. The Council confirms the amount of the membership fee annually (AFLRA). The ALFRA coordinates a climate protection campaign of municipalities. It is funded by the membership fees, by the sale of services and by the commission for the local authority employers. ICLEI's Cities for Climate Protection (CCP) is active in Finland and aims at encouraging cities and municipalities to plan and initiate their own actions to reduce greenhouse gas emissions (ICLEI Europe 2009).

Decisions on GHG emissions such as traffic and land use planning, waste management and energy consumption and production are taken by municipalities themselves (Local and Regional Government Finland 2008). They also give environmental permits to smaller industrial plants not included in the RECs mandate. About 40 municipalities, accounting for more than 50% of Finland's population and four regions have calculated their greenhouse gas emissions. More than 20 municipalities and cities have also prepared their climate strategies or action plans (Government of Finland 2006). The City of Kuopio conducted its first survey of greenhouse gas emissions in 1997. It has carried out numerous local activities and drew up reports on the possibilities to reduce the cities' emissions. In 2003, it became one of the first Finnish cities to have a local climate strategy. To establish its strategy, the city worked with the national Climate Change Information Programme, Motiva Oy, the AFLRA and local actors (AFLRA).

On the adaptation side, in 2005, an Adaptation Strategy was submitted to the parliament as a part of Finland's National Energy and Climate Strategy. submitted to Parliament in November 2005. The strategy outlines knowledge on projected climate impacts, and defined measures to improve Finland's climate adaptation capacity for adapting to future climate change. It was created with the collaboration of Finnish climate change researchers, representatives of different sectors, and different stakeholders. Among collaborators, FINADAPT, a consortium, co-ordinated by the Finnish Environment Institute (through the Finnish Environmental Cluster Research Programme), and 11 Partner institutions covering many adaptation topics. Principally funded by the Ministry of Environment, the Ministry of Employment and the Economy, the Ministry of Agriculture and Forestry, the Ministry of Transport and communications and by the National Technology Agency, the Finnish Environmental Cluster Research Programme works with researchers, private and public actors and funding organisations. It aims at rising levels in environmental knowledge and to integrate environmental issues in National innovation. The programme is now in its fourth phase focussing on five environmental items including climate change.

Multilevel governance in New Zealand

According to their 2004 Resource Management Amendment Act (Energy and Climate Change), New Zealand central government has a preference for national coordination when it comes to taking climate change related decisions. However, this act describes local government responsibilities towards the effects of climate change and aims at making local decisions consistent with national management of greenhouse

gas emissions (Ministry for the Environment 2009). The Energy Efficiency and Conservation Authority has also produce guidance for decision makers and planners for local governments by.

In 2007, New Zealand's national government introduced a new policy package containing several policies involving different ministries (Ministry for the Environment 2005b). In the new policy package, the Ministry for the Environment is responsible for the national Emissions Trading Scheme (NZ ETS), the waste management strategy, the adaptation programme and the public awareness programme. Sector responsibilities are delegated to line ministries, i.e. the ministries of Transport, of Economic Development, of Agriculture and Forestry, the Agency for Energy Efficiency and, the Conservation Authority are each responsible for climate change related issues in their own sector. The Ministry for the Environment partners with organisations such as local government, engineers, the insurance industry and the agriculture sector to produce information and guidance materials on climate change impacts (Ministry for the Environment 2005a).

Local Government New Zealand (LGNZ) is an organization created to facilitate dialogue in Government at Ministerial, Caucus, and Agency levels on matters of national interest. It ensures a commitment between the two arms of Government in New Zealand and maintains a link between Parliamentarians and local body organisations (Local Government New Zealand 2008, ICLEI Oceania 2008, Government of New Zealand 2005). The Ministry for the Environment works with LGNZ to assist local authorities to mitigate and adapt to climate change. With respect to climate change, the partnership aims to improve awareness, understanding and acceptance of the effects of climate change within the local government sector.

Local government work is also conducted in partnership with the ICLEI New Zealand through the Communities for Climate Protection greenhouse gas emissions reduction programme. It focuses on achieving political momentum in city councils to take mitigation action. In September 2008, ICLEI New-Zealand launched the "Carbon Neutrality Framework for Local Government" which proposes a carbon neutrality framework to be established by local governments (ICLEI Oceania 2008). It therefore assists council staff to develop greenhouse gas emission inventories, to set targets for emission reductions, to develop local action plans, and to put in place monitoring programmes for emissions reductions.

Multilevel governance in Portugal[59]

In Portugal, the project "Climate Change in Portugal: Scenarios, Impacts and Adaptation Measures" (SIAM) brings together scientists from various disciplines. The main objectives of the research are:

- To conduct research on climate change impacts, mitigation and adaptation measures at local, national and international levels;

- To disseminate information on climate change impacts and mitigation.

The Portuguese political response to climate change is translated into the National Programme to Climate Change, as a Central Government plan, conceived on a sector basis. This sets a global framework for the action of local authorities, while the National Adaptation Strategy to Climate Change is being prepared.

Several local communities have started to take action in: savings in energy use, renewable energy resources, public transportation, infrastructure design, land use planning and zoning, waste and green

[59] Section contributed through written comments from the Government of Portugal, delegation to the OECD, in June 2009.

procurement programmes, etc. As an example of good practice, Sintra (nearby Lisbon), is the first Portuguese municipality with a strategy of adaptation to climate change, designed in collaboration with the SIAM team.

Multilevel governance in Sweden: KLIMP – Sweden's Climate Investment Program

The Swedish national government has been at the forefront of GHG emissions reduction for a long time now. Its use of climate policy instruments has significantly reduced Sweden's emissions. Sweden is one of the few countries that present emissions below the level recorded in 1990 (by an average of over 4 %) (Ministry of Sustainable Development 2005). Swedish local governments are responsible for decisions concerning land-use and water. Thus, responsibility for managing climate-related risks and physical planning, and adaptation, lies largely with municipalities. Cities are also active players in key areas that will affect urban GHG emissions and thus mitigation. With respect to energy efficiency and supply for built infrastructure, cities issue formally permit for the building of new heat and power plants and heat pump installations. However, it is market conditions that govern if new plants are to be built or not. The central government has a long tradition of top-down policy directives and mandates requiring municipalities to align local policies with national objectives. Within this system, municipalities are often provided with substantial financial, legal and professional resources to align themselves with national policy (Nykvist and Whitmarsh 2008).

Importantly, there is a national programme that provides financial support to local governments to manage emissions and to adapt to climate change (Swedish Environmental Protection Agency 2004). First, the Local Investment Programme for Ecologically Sustainable Development (LIP) was operative from 1998 to 2002. Its aim was to stimulated environmentally friendly actions and employment. The LIP programme have invested a total of SEK 4.7 billion in 211 programmes, with the half of it being invested in climate change related projects. LIP's overall assessment is an estimated 1.5 million tonnes of CO2 reduction per year (Ministry of Sustainable Development 2005, Kern, Gotelind 2009). The KLIMP program started in 2003 to succeed the LIP programme and focused on climate projects only. Through this program, local governments are able to apply for national subsidies which can be used to promote local investments to reduce GHG emissions and improve their energy independence (Johansson P., Nylander & Johnsson 2006). By combining the two programmes around SEK 25 billion were injected in climate projects from 1998 to 2008, which SEK 6 billion came from the national government (Kern, Gotelind 2009).

The Swedish Environmental Protection Agency manages the KLIMP programme, which to date has focused on CO2 abatement (Swedish Environmental Protection Agency 2004). Examples of funded municipal activities include removing disincentives for individuals to reduce emissions, such as eliminating free parking, and subsidising retrofit of filling stations to add a pump to supply renewable bio-fuels (Swedish Environmental Protection Agency 2004). Through KLIMP, cities also subsidize the replacement of inefficient oil boilers with more efficient equipment in residential and commercial buildings as well as investments in GHG reducing measures or facilities by energy companies or other industries (Johansson P., Nylander & Johnsson 2006). KLIMP program activities include many sectors and have real impacts on CO2 production in Swedish municipalities. The Swedish Environmental Protection Agency estimates total CO2 emission reduction to be 1.1 billion tonnes per year for a total investment of EUR 215 million per year (Swedish Environmental Protection Agency 2009).

Attributed through a competitive process, eligibility for KLIMP grants requires that cities develop a climate strategy including overarching and intermediate objectives, locally adapted policy measures as well as strategies for follow-up and evaluation. The Investment Support Council, where members are appointed by the Swedish Environmental Protection Agency, examine the applications with the National Board of Housing, Building and Planning, the Swedish Energy Agency and the Swedish Road Administration and

grant projects with the cost-effective potential (Swedish Environmental Protection Agency 2009). Funding provided by the central government can go from 25 to 85% of total program costs, placing responsibility for the remainder on the municipalities themselves (SEPA 2004; Kern and Gotelind, 2009). Between 2003 and 2008, KLIMP funding totalled about EUR 214.9 million (SEK 2.0 billion), supporting 126 climate investment programmes in several cities (Swedish Environmental Protection Agency 2009). The grants have been invested in municipalities, municipal associations, county councils and companies in all counties throughout Sweden. Most of the KLIMP grants focused on energy (52%) and transportation (25%) issues (Storbjörk 2007). The Swedish environmental protection agency monitors the program by re-evaluating the grant attributed a project according to its final mitigation performances.

Objectives of the KLIMP program have evolved along with better understanding of climate change, among other things, to place increased emphasis on adaptation. The 2007-2008 funding cycle attempts to press municipalities to see climate change in the broader context to address both mitigation and adaptation in their climate strategies. As part of this effort, the Värmland region, consisting of 16 municipalities, has created an energy office as common information and support resource on adaptation; it is partnering with smaller municipalities to develop grant applications and programs. While pure educational work can be part of submitted projects, applications must also include clearly visible and tangible measures in investments (Storbjörk 2007).

Table 11. Overview of Swedish National-Local Climate Programme

Programme / Administering Organisation	Objectives	Implementating organisation	Type of actions	Targeted population	Funding Source / Annual budgetary costs
KLIMP / Swedish EPA 2003/2008	• Stimulating investments that can lead to the reduction of greenhouse gas emissions; • Strengthening local climate work and cooperation between national and local actors; • Collecting and disseminating knowledge and experience of climate investments to encourage climate work in other parts of the country.	Swedish Investment Support Council	• Provide grants to local governments for cities to outsource private energy companies; • Promote energy efficient investments to reduce emissions and dependence on markets.	Local decision makers	Swedish EPA EUR 214,9 Millions/5 years
LIP / Swedish EPA 1996/2002	• Speeding up the transition of Sweden to an ecologically sustainable society; • Helping to raise employment levels.	Swedish Investment Support Council	• Reducing GHG emissions; • Attributing grants in areas where environmental needs of municipalities are the greatest and where municipalities are most able to make improvements.	• Municipalities • Local companies • Local organisations	Swedish EPA EUR 576 Millions/6 years

Oregon and Portland Green Building Multilevel Governance

The city of Portland Oregon has long been a leader in the United States on green building innovation. Its green building program started when, in 1994, a volunteer citizen group was created to inform city council decisions concerning sustainable development and commissioned a planning process to explore the potential for a local green building technical assistance program (City of Portland Bureau of Planning and Sustainability 2009b). Their action plan eventually led to the creation of the Green Building Division, in the City's Office of Sustainable Development (OSD) in 2000 and they quickly implanted local measures to stimulate and encourage the green building sector. The Green building program is one of its first achievements. At the city scale, the Green Building program is a partnership of development-related City bureaus and local organizations. It focuses on policy development, demonstration projects, technical assistance, education and financial incentives (City of Portland Bureau of Planning and Sustainability 2009b). It is funded through residential and commercial solid waste fees, and grants.

The Green Investment Fund (GIF) is a part of Portland's Green Building Program developed in 2001. It supports early building, project that has potential to be used as examples and comprehensive green building project (City of Portland Bureau of Planning and Sustainability 2009c). GIF grants are intended to offset the costs of the green building measures. At the beginning, it was funded and managed by the Office of Sustainable Development reorganized in January 2009 by merging it with the Bureau of planning to

form the Bureau of Planning and Sustainability. However, in 2004, the GIF expanded to include the Energy Trust of Oregon, the Bureau of Environmental Services, and the Water Bureau as a partnering agencies (City of Portland Bureau of Planning and Sustainability 2009c).Over the last six years, the Fund has provided over 2,5$ million in funding to residential, commercial, industrial and innovation projects; 70% of the grants are financed by the City of Portland and 30% by Oregon Energy Trust (EDAW 2008). The Fund is managed by the city of Portland Bureau of Planning and Sustainability in partnership with contributors (EDAW 2008).

At regional scale across the state of Oregon, there is also movement to require that new and renovated buildings achieve high levels of energy efficiency. The Oregon Building Code Division established a building code requiring that new and refurbished meet environmental and energy efficiency performance criteria in its 2008 edition (Oregon Housing and Community Services 2009). Following these regional measures, several green building firms in Portland indicated that the demand for their services outside the region of Portland was increasing significantly (Allen, Potiowsky 2008). To continue leading in the green building field, the City of Portland's Bureau of planning and sustainability recently proposed a building code that goes the State standards (City of Portland Bureau of Planning and Sustainability 2009a).

The state-wide building code is part of a suite of mitigation reported in the State of Oregon climate change plan, which was adopted in 2004 (State of Oregon 2004). In addition, in 2007, the Oregon government created the Oregon Built Environment and Sustainable Technologies Research Center (BEST), therefore acknowledging the need for a sustained governmental policy support in the green building sector and the competitiveness of the national sustainable market (Allen, Potiowsky 2008). BEST is an independent, non-profit organization with a mission to develop and expand a network of university researchers, laboratories, and equipment in green building products and services and in renewable energy generation (Oregon Best 2008). It aims to develop, transfer and commercialize the results of university led research by creating new companies, services and products. It also aims to foster industry-university collaboration and to help new and existing Oregon companies in the utilization of the shared network of university research labs and renewable energy sectors to develop and make their products more competitive (Oregon Best 2008).

Another important institutional actor is the Oregon Housing and Community Services (OHCS) which is responsible on one hand for the interface between regulators and regulations and on the other for citizens and stakeholders. It is promoting green building awareness through regional workshops and publications (Oregon Housing and Community Services 2009). One of its principal publication is the Green Building Source Guide published in 2002 (Oregon Housing and Community Services 2002), providing helpful links to websites providing technical information on green building. National incentives are also in place to stimulate green building practices: the Oregon Business Energy Tax Credit and the State Loan Program are often defined as key ingredients in the Oregon's leadership in the green building sector (Allen, Potiowsky 2008). The State level initiatives were taken after the City of Portland was already defined as a leader in the green building sector. In 2007, the City of Portland had the highest number of LEED certified buildings in the country, and was attracting firms and qualified workers from around the country (Allen, Potiowsky 2008).

Sao Paulo and CDM

Brazil has a higher per capita emissions ratio than the emerging countries average, the country is currently ranked 6th in cumulative country emission (Stezer 2009). With respect to GHG emissions, the country sees the Kyoto Protocol and its mechanisms as the most appropriate instrument for the reduction in GHG emissions (Embassy of Brazil in London 2007). As a Non-Annex I party to the UNFCCC, Brazil has no national target for emission reductions. On the other hand, Brazil is one of the countries which has been

active CDM projects (Puppim de Oliveira 2009). A growing number of initiatives are being taken at subnational levels, such as for the city and state of Sao Paulo.

The State of Sao Paulo is the most populous state in Brazil with 98% of its population living in urban areas. The State is responsible for 25% of the country's emissions and figures among the 40th largest source of CO2 emission in the world. The State and the City of Sao Paulo both have, in principle, the authority to legislate on environmental protection and pollution control. Transnational networks of non-state actors first played an important role in the creation of a state-level climate change framework in the 1990s (Setzer 2009). In the early 2000s, the City of Sao Paulo, started considering climate change policies in part as possible solutions for local air pollution; local and regional ghg emissions reduction legislation could be justified by their economic and public health benefits (Setzer 2009; Puppim de Oliveira 2009). In 2002, the City of Sao Paulo published its Agenda 21, greatly focused on climate change. In 2003, the municipality joined ICLEI's Cities for Climate Protection (CCP), a campaign promoting local climate change policymaking (ICLEI 2007). Through the CCP program, Sao Paulo completed an inventory of its emissions, which showed that land transportation (48.6%) and landfills (23.5%) were the main sources of the city's GHG emissions. In 2005, the State of Sao Paulo and the State of California signed an agreement on technical cooperation between the two States. Recognizing the need to act in climate change related sectors, the agreement also acknowledge the potential economical gains in working on emissions offset programs through Kyoto Protocol's CDM.

The city then developed several initiatives to mitigate GHG emissions centering on the use of CDM. The Bandeirantes Landfill Gas to Energy Project (BLFGE) was implemented by the City of Sao Paulo jointly with local private company Biogas Ambiental, and in cooperation with German Bank KGW and private firm Van der Wiel and Arcadis (Netherlands) (UNFCCC 2005). The project generates energy from the landfill methane emissions. From 2004 to 2010, the BLFGE project will have contributed to a reduction of 7,500 000 tonnes of GHG (UNFCCC 2005). The project has already reduced GHG emissions by 11% in the City of Sao Paolo (Cunha & Rei 2006). In 2006, Sao Paulo city hall obtained 34 million Real (USD 16 Million) form the sale of carbon credits generated by the CDM project were sold, invested in social projects in the area of the landfill and also on climate change mitigation (Puppim de Oliveira 2009).

Sao Paulo city hall also acted in transport and building sectors. Specifically, the city introduced hybrid buses in the municipal transportation service with financing help from the GEF and started a program of automobile inspection and traffic restriction during the rush hour (Puppim de Oliveira 2009). In 2007, the City of Sao Paolo passed a solar energy bill, now used as model by more than 50 other Brazilian cities (Cunha & Rei 2006). The bill mandates, among other things, buildings with more than 3 bathrooms (homes, apartments, service or industrial buildings) to use passive solar heating systems. Expected impacts are 3400 tonnes CO2 reduction and 8.7 million kWh of energy saved per year.

Cape Town – South Africa

South Africa has experienced a robust growth from 2004 to 2008 as the country's economy stabilized itself and global commodities boomed. However in this period, both high unemployment and outdated infrastructure have constrained growth. Further, the global financial crisis has considerably slowed South Africa's economy in the second half of 2008. South Africa began to experience electricity and water shortages as state services suppliers suffered problems with aging plants, necessitating cuts to residents and businesses in the major cities. A lot of South Africa is already suffering from unimproved water sources, only poor water quality can be accessible in some parts of the country, thus contributing to a range of health problems. More people are likely to suffer from water problems has extreme water events frequency increase (Boko et al. 2007). Although many challenges exist, there is a need and there is now strong national and regional support for cities to act on and take measures to handle climate related events.

Drivers for these actions are mainly governments and non-governmental organizations or agencies (Hunt, Watkiss 2007).

There is a will to adapt to climate change at national, regional and local scale. On the national scale, infrastructure provisioning and service delivery is mostly part of the Reconstruction and Development Program (RDP) which recently laid out the Government's economic and social growth vision respect to the environment (Mukheibir and Ziervogel, 2007b). Since 2004, in order to better adapt municipal and regional infrastructures to climate related events, the South African Government has emphasized on investment in urban infrastructure as a key objective in the country's growth and social development when creating the National Spatial Development Perspective (NSDP). The NSDP ensures that investments made in public infrastructures meet their target in areas where it is the most needed (Swilling 2006). The national government's mandated to facilitate municipal infrastructure development is carried out through the Municipal Infrastructure Grant (MIG), investing over R15 Billion over a three year period starting in 2004 ((DPLG 2007). The major sources of funding are the Industrial Development Corporation (IDC), the Development Bank of Southern Africa (DBSA) and state-pension funds (PIC) in South Africa.

One of the biggest challenges faced by the City of Cape Town is the supply of water services. The integrated Water Resource Planning Study recognized the need to adopt an integrated water resource planning approach to address the effects of stresses on the supply of water (Mukheibir and Ziervogel, 2007a). In 2004, the City of Cape Town created a better water conservation plan; by introducing a long term sustainability strategy, this complements the pre-existing water demand management strategy developed by the City of Cape Town in partnership with the national department of Water Affairs and Forestry. The plan introduces adaptation measure such as water pricing, restriction, leak reduction and pressure management (Mukheibir and Ziervogel, 2007a). In 2006, the city developed a comprehensive framework to address climate change, which included alternative approaches to implement and finance mitigation and adaptation investments. Climate change adaptation and mitigation have also benefited from locally driven non-governmental organizations formed during the apartheid (Hunt and Watkiss, 2007).

New York City

With over 8.3 million inhabitants, New York City is the largest city in the United States. Like other coastal cities in the world, New York City will be dealing with more frequent climate events by the 2050's. Temperature in New York are forecast to rise by 1.5 to 3 degrees Fahrenheit (0.5 – 1.5 Celsius) by the 2020's and by 3 to 5 degrees Fahrenheit (1.5 – 2.5 Celsius) by 2050's (NPCC 2009). Many problems are associated with this temperature rise (i.e. drought, heat waves, precipitations), however one of the most challenging concerns stemming from climate change is sea-level rise, with water levels expected to increase from 4 to 12 centimetres by 2020, and by 30 to 56 centimetres by the 2080s (Mehrotra et al. 2009). For New York City, coastal storms and flooding will lead to several infrastructural problems including street, sewer and low-level infrastructure flooding, bacteria and parasite problems in potable water reservoirs.

Decisions taken now in the field of infrastructure will greatly affect the quality of life of those citizens in decades to come. As in many field, environmental management in the City of New York deals with a much bigger region. For example, the NYC water system is made up of 18 storage reservoirs, 3 controlled lakes, 210 miles of aqueducts, 2 balancing reservoirs, distribution facilities and tunnels and over 6,200 miles of distribution mains (Rosenzweig et al. 2007). In dealing with climate, New York City decision makers necessarily have to work with actors at several scales (i.e. state and local agencies and stakeholders) (Mehrotra et al. 2009). Initiated at high levels on the local and regional scale, the city and state of New York have recently developed climate change adaptation strategies to cope with a full range of predicted risks. Public authorities are now better equipped to undertake climate change mitigation and adaptation strategies (Mehrotra et al. 2009).

The NYCDEP[60] Climate Change Program is designed for decision-makers to have better tools when dealing with climate impacts, adaptation, review, and monitoring. In 2004, the New York City Department of Environmental Protection (NYCDEP) launched the Climate Change Task Force (City of New York 2009). The CCTF was created to ensure that NYCDEP'strategic planning was taking into account the potential effect of climate change on New York City's water infrastructures. Later, in 2008, NYC Office of Long Term Planning and Sustainability created the NYC Climate Change Adaptation Task Force. The mandate of the task force is to support municipal decision-making by developing a risk management plan, by evaluating climate change impacts and by developing mitigation and adaptation strategies. The Climate Change Task Force also has a mandate to coordinate scientific research across the research community as well as input from social researchers and other experts (Rosenzweig et al. 2007, City of New York 2009). Finally, by working with researchers, the NYCDEP aims to improve its regional climate modelling therefore reducing uncertainties in climate projections and improving infrastructure and investment planning (City of New York 2009).

In 2008, NYCDEP also worked with Columbia University's Center for Climate Systems Research (CCSR) to develop an analytic framework for analyzing climate change impacts and developing an action plan (CCSR 2009). The framework includes an adaptation assessment procedure which is divided into management, infrastructure and policy categories assessed by time-frame. It elaborates potential adaptation projects among which are storm surge barriers and new design criteria for infrastructures. Finally, NYCDEP is a member of the EU CLIME (Climate and Lake Impacts in Europe) project aiming at developing integrated regional water quality models to increase knowledge about climate change impacts on local watersheds (Mehrotra et al. 2009, CCSR 2009).

Catalonia/Barcelona

Since the end of the 1970's, Spain has become one of the most decentralized countries in Europe. The modification of the Spanish Constitution of 1978 established a federal state containing seventeen autonomous governments including Catalonia: the Generalitat. Each autonomous government has negotiated its constitution with the federal State of Spain. Regional Governments now bear the legislative and executive power in many areas. As a State-level authority, the Generalitat has the mission to manage land use planning, economic development, transportation as well as health and environmental issues. The Generalitat also manages the territorial planning and infrastructure development, urban centres and suburb organization, and the distribution of economic activities. Comarcas are smaller territorial inter-municipal entities determined by the areas of urbanization and economic development. Their mandate is to manage services defined by the Generalitat. They provide legal and technical assistance to small municipalities. There are 7 Comarcas in the Barcelona Metropolitan Region. Finally, municipalities manage the urban planning of cities and adjacent area (Laigle 2009).

The Catalan Office of Climate Change is the Government of Catalonia's main vehicle for advancing mitigation and adaptation to climate change. It aims to coordinate local actions and local GHG reduction policies in Catalonia, to work with different sectorial actors (i.e. public and private actors in transport, buildings and waste), to project future climate scenarios, and to provide support for the scientific community to better understand the impacts of climate change (Government of Caledonia, 2008). The mission is to develop and apply climate change mitigation and adaptation policies. It depends on the Directorate for Environmental Policies and Sustainability and is financed by the Department of the Environment and Housing. In 2007, the Office was funded at a level of EUR 1 million to work towards its mandate (Government of Caledonia, 2008). The Office also supports information sharing through the Catalan Network of Cities and Towns towards Sustainability.

[60] New York City Department of Environmental Protection

In 2007, the Catalan Office of Climate Change, the Sub-Directorate General of Environmental Information and Education organized the Catalan Convention on Climate Change with the support of the Directorate General of Citizen Participation. Catalan citizens were highly involved by the Convention and contributed to its final product. Private sector stakeholders, scientists, county councils and provincials councils also have participated in the process. The Convention ended in 2008 with a preliminary draft of the Catalan plan to mitigate climate change. The 2008-2012 Catalan Plan to Mitigate Climate Change identifies measures needed to achieve targets defined in the European Union Emissions Trading Directive as well as ideas that came out of the Convention. It includes a programme of actions aimed at driving research, awareness-raising and participation. Projects launched by the plan include express buses, the anaerobic digestion of liquid manure and methane capture. The plan also contains elements for adapting to climate change. For example, the government of Catalonia is studying and measuring the possible impacts of climate change in the Ebro Delta (Government of Caledonia, 2008).

The metropolitan area of Barcelona has 4.9 million inhabitants, which represents a total of 70% of Catalonia's population; over 1.6 people live in the City of Barcelona. The urban region has a strong economy mainly specialized in industrial activity, the fifth largest industrial region in Europe. Since the 2000s, municipalities and local organizations in the metropolitan region have begun to advance concrete strategies for sustainable development. The City of Barcelona recently created the Urban Ecology Agency whose mission is to develop expertise on local sustainability. The Agency has begun to develop tools to assess urban ecosystems, its environmental impacts and its capacity for resilience (Laigle 2009).

ANNEX B: INFORMATION ON REGIONAL IMPACT SCIENCE-POLICY INSTITUTIONS

IRI

Created in 1996, the International Research Institute for Climate and Society (IRI) collaborates with local institutions and stakeholders that understand local needs in Africa, Asia and Latin America. After having studied the region's basic social structure, the IRI chooses the regions and partners it wants to be involved with (Agrawala *et al.*, 2001). It focuses on its partners' climate risks management strategies and aims at strengthening them through the integration of climate risk management. "IRI participates in the transnational flow of technical knowledge and skills, usually along a gradient from North to South" (Agrawala *et al.,* 2001). Their research and tools help address development and adaptation issues in developing countries (IRI, 2007). IRI works collaboratively with the local and national partners to help them better plan and manage activities. Its climate change projects focus on actions needed to improve actual outcomes and the future interactions of environmental, economic and social systems with the climate (IRI, 2008). Their focus is on four major points (IRI, 2007): (1) understanding the local decision process; (2) sharing useful climate information to meet the needs of the decision makers, disentangling short-term from long-terms issues; (3) linking institutions and building capacities to improve climate risk management; (4) developing climate information and generating tools that meets the local decision makers needs.

Ouranos

Ouranos was created in 2001 in a joint initiative by the government of Quebec, Hydro-Québec and Environment Canada to provide them with an organisation capable of linking climate science with the needs of different sectors of society. Its mission is to acquire and develop knowledge on climate change in order to inform decision makers about probable climate trends and advise them on identifying, assessing, promoting and implementing local and regional adaptation strategies (Ouranos, 2008). This involves developing structures for analysis of multidisciplinary problems, promoting synergetic work, developing tools or climate scenarios required to support vulnerability and impact assessments, and develop adaptation strategies (Vescovi *et al.,* 2007). Among its partners, eight provincial departments and agencies are involved, along with three universities. Ouranos can also provide external clients and stakeholders with reliable regional climate projections. Ouranos meets the needs of its partners from various sectors and defines effective adaptation strategies according to the specific needs (Ouranos, 2008). The communication between climate specialists, impact researchers, and user groups is co-ordinated by Ouranos. Thus, evaluation of the potential impacts is ensured and the development of adaptation solutions is facilitated (Vescovi *et al.*, 2007). The organisation's budget amounts to about 5 million Canadian dollars (CAD) per year and is generating CAD 12 million of external resources (Ouranos, 2008b). Its source of funding mainly comes from Quebec's *Ministère du développement économique, de l'innovation et de l'exportation* (MDEIE). It also received, in 2008, a CAD 10 million grant from the government of Quebec for its impact and adaptation work.

PIER programme

Over the last decade, the California Energy Commission (CEC) has developed the Public Interest Energy Research Programme (PIER), which includes an Environmental Area covering climate change modelling and policy research (Franco, 2005). Part of the PIER mission is to conduct and fund research in

the public interest that would otherwise not occur. The PIER programme, managed through the CEC, co-ordinates a broad-based research effort on climate change and solicits collaboration by partnering with research and development organisations, individuals, businesses, utilities, and public or private research institutions with experts throughout the state. The programme often leverages funding through this collaborative model, working with various institutions throughout the state. Ongoing national and international research efforts are the basis of its research program and funding of research projects to inform policy makers in the state (Franco *et al.,* 2008). In 2003, PIER programme created a five-year research plan on climate change in California. To implement it, the PIER programme created the (virtual) California Climate Change Center (CCCC), the first state sponsored climate research programme in the United States (Franco *et al.,* 2008). Although the Center is managed by the California Energy Commission, Scripps Institution of Oceanography at the University of California at San Diego and the University of California at Berkeley (CEC, 2008b), it draws on research partners from a broad network of (public and private) universities and institutions across the state. A number of major outcomes include improved capability for California to make informed, scientifically and economically grounded decisions on climate change mitigation and adaptation, including applications the management of water and agriculture, electricity and energy among other sectors (Franco *et al.,* 2008). The PIER programme allocates roughly USD 4 million to USD 6 million per year to climate change research (CEC, 2008).

UKCIP

The United Kingdom Climate Impacts Programme (UKCIP) was founded in 1997 to help co-ordinate scientific climate change research, and to help organisations adapt to its impacts (UKCIP, 2008). To achieve its main objective, UKCIP works with scientists, policy makers and stakeholders to co-ordinate and influence climate research and to share the useful outputs with stakeholders. UKCIP supports the development of institutional capacity by raising stakeholders' awareness on the need to adapt and by providing tools allowing decision makers to make well-informed decisions when choosing adaptation strategies (McKenzie *et al.,* 2006). The Programme recognises that stakeholders can be experts in their domains and that the information provided by them allows researchers to use the best available regional information (McKenzie, 2006). It works on a contract basis with different sub-national regions or local communities to assess possible climate change impacts, vulnerability and adaptation options. While areas explored in the initial stages of a typical contract might include high impact-low probability events and to define the implications of climate impacts, the emphasis can rapidly shift to equipping stakeholders for adaptation (UKCIP, 2008), which in practice means combining the latest cutting-edge academic research with decision makers' knowledge of what works in practice (UKCIP, 2005). The majority of UKCIP's funding is from the Department for Environment, Food and Rural Affairs. Other contributors include the Environmental Change Institute (Oxford University) and the Government's Knowledge Transfer Partnership scheme (UKCIP, 2005).

Club ViTeCC – Villes, Territoires et Changement Climatique

Focused on cities, territories and climate change, Club ViTeCC's main objective is to provide local authorities, stakeholders, private and public sectors and citizens with information on their role in climate change mitigation and adaptation by bringing together economists, scientists and engineers for informal discussions three times yearly (CDD, 2008). In 2007, the *Mission Climat,* in cooperation with *Météo-France* and the National Observatory on Climate Change Impacts (ONERC), launched Club ViTeCC as part of its work in analysing the linkages between climate change mitigation, adaptation and urban infrastructures in France. The club aims to make scientific and technical information understandable to local decision makers and to develop the proper decision tools on emission reductions funding and management of urban infrastructure adapted to future climate risks (*Association pour la Recherche en Economie du Carbon* or APREC, 2008). The club functions as a forum, bringing together French local leaders (cities, towns, counties, regions, urban planning agencies etc.), management firms (energy,

construction, transport, water, financial services) and recognized climate change and economic infrastructure experts. Preparation of the Club is principally coordinated by the Mission Climat de la Caisse des Dépôts, a French research centre focusing on the analysis of the carbon economy. Participation in Club ViTeCC is subject to an annual fee;[61] revenues from the fee are dedicated to funding the operations and research conducted for the club. Club ViTeCC is a non-profit organisation.

[61] The fee set for 2008 was EUR 4 000 for the public and EUR 16 000 for companies. Club ViTeCC funds are managed by the *Association pour la Recherche en Economie du Carbone* (APREC), founded by the *Mission Climat* of *Caisse des Depots* and the Université Paris Dauphine

BIBLIOGRAPHY

Aall, C., K. Groven, and G. Lindseth (2007), *The Scope of Action for Local Climate Policy: The Case of Norway*, Global Environmental Politics, Vol. 7.2, pp. 83-101.

ACIA. (2004), *Impacts of a Warming Arctic:* Arctic Climate Impact Assessment, Cambridge: Cambridge University Press.

AFLRA. *Local Authorities and Climate Change*, ALFRA, Helsinki.

Agrawala, Shardul, Kenneth Broad and David H. Gutson (2001), "Integrating Climate Forecast and Societal Decision Making: Challenges to an Emergent Boundary Organization", *Science, Technology, and Human Values*, Vol. 26, No. 4, *Special Issue: Boundary Organizations in Environmental Policy and Science* (Autumn, 2001), pp. 454-477.

Allen, J.H. and T. Potiowsky (2008), "Portland's Green Building Cluster: Economic Trends and Impacts", *Economic Development Quarterly,* Vol. 22, pp. 303-315.

Anderson, James (1975), "Public Policy-Making". In Paul a Sabatier. ed., Theories of the Policy Process, Colorado: Westview Press.

APREC (2008), *ViTeCC: villes, territoires et changement climatique : Choix et gestion des infrastructures*, www.aprec.net/documents/plaquette_club_vitecc_2008.pdf, accessed 20 October 2008.

Aron, Joan Leslie and Jonathan Patz (2001), Ecosystem change and public health: a global perspective, JHU Press

Australian Government (2007), "Climate Change Adaptation Actions for Local Government." Report by SMEC Australia, Australian Greenhouse Office Department of the Environment and Water Resources.

Bäckstrand, K. (2002), "Civic Science for Sustainability: Reframing the Role of Scientific Experts, Policy-makers and Citizens in Environmental Governance," in F. Biermann, S. Campe, and K. Jacob (eds.), Proceedings of the 2002 Berlin Conference on the Human Dimensions of Global Environmental Change "Knowledge for the Sustainability Transition. The Challenge for Social Science, Global Governance Project: Amsterdam, Berlin, Potsdam and Oldenburg, pp. 165-174.

Baettig, M., M. Wild, and D. M. Imboden (2007), A Climate Change Index: Where Climate Change May be Most Prominent in the 21st Century, Geophysical Research Letters 34:1-6.

Bayon, R., A. Hawn and K. Hamilton (2007), *Voluntary Carbon Markets*, Earthscan, London.

Beatley, Timothy (2000), *Green Urbanism*: Learning From European Cities, Washington, DC, Island Press.

Beck, S., C. Kuhlicke, and C. Görg (2009), "Climate Policy Integration, Coherence, and Governance in Germany," Helmholtz Zentrum Für Umweltforschung, UFZ-Bericht, January 2009.

Beniston, Martin (2004), The 2003 Heat Wave in Europe: A Shape of Things to Come, An analysis based on Swiss Climatological Data and Model Simulations, Geophysical Research Letters 31:1-4.

Benton, S. (2008), "Climate Change Strategy Announced for SA," BuaNews, buanews.gov.za, accessed 19 July 2008.

Bernard, Susan M., Jonathan M. Samet, Anne Grambsch, Kristie L. Ebi, and Isabelle Romieu (2001), *The Potential Impacts of Climate Variability and Change on Air Pollution-Related Health Effects in the United States*, Environmental Health Perspectives, Vol. 109.

Betsill, M., and H. Bulkeley (2004), "Transnational Networks and Global Environmental Governance: The Cities for Climate Protection Program," International Studies Quarterly, Vol. 48, pp. 471-493.

Betsill, M., and H. Bulkeley (2006), "Cities and the Multilevel Governance of Global Climate Change," Global Governance, Vol. 12, No. 2, pp. 141–159.

Betsill, Michele and H. Bulkeley (2007), "Looking Back and Thinking Ahead: A Decade of Cities and Climate Change Research", Local Environment, Vol.12:5, pp. 447 - 456

Biermann, Frank, and Klaus Dingwerth (2004), Global Environmental Change and the Nation State. Global Environmental Politics Vol. 4 (1), pp.1-22.

Bigio, A. (2003), " Urbanization and Natural Disasters in the Mediterranean: Population Growth and Climate Change in the 21st Century," Kreimer, A., Arnold, M. and A. Carlin (eds.) in Building Safer Cities: The Future of Disaster Risk, The International Bank for Reconstruction and Development, The World Bank, Washington, DC, pp. 81-99.

Bintliff, E., A. Kashiwagi, M. Liu, M. Margolis, and A. Underwood (2007), "Cities of Virtue", Newsweek, 16-23 April 2009, pp.76-79.

Blanco, A.V. (2006), "Local Initiatives and Adaptation to Climate Change," Disasters, Vol. 30, No. 1, pp. 140-147.

Bodiguel, A., Y. André, B. Leguet (2008), *Domestic Offset Projects* : Implementing the Kyoto Protocol, Caisse des Dépôts; Mission Climat, Paris, France.

Bohman, James (1996), *Public Deliberation*: Pluralism, Complexity, and Democracy, Cambridge, MA: MIT Press.

Böhme, Rolf (2001), Transport and energy. Bucking the trend: Freiburg's green transport policies are central to the city's development. In: Our Planet, Vol. 12, No.2: Transport and Communications, http.//unep.org/OurPlanet/imgversn/121/bohme.html.

Boko, M., I. Niang, C. Vogel, A.Githeko, M. Medany, B. Osman-Elasha, R. Tabo, and P. Yanda (2007), "Africa" in: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by Parry, M.L., Canziani, O.F., Palutikof, J., van der Linden, P.J. and Hanson, C.E., Cambridge (UK), pp. 433-467.

Bollen, J., B. Guay, S. Jamet and J. Corfee-Morlot (2009), Co-benefits of Climate change Mitigation Policies: Literature Review and New Results, OECD Economics Department Working Paper, forthcoming, Paris.

Börzel, Tanja A. (1998), *Organizing Babylon* - On the Different Conceptions of Policy Networks, Blackwell Publishers Ltd, (1998). Brauch, H.G. (2003), " Urbanization and Natural Disasters in the Mediterranean: Population Growth and Climate Change in the 21st Century," Kreimer, A., Arnold, M., and A. Carlin (eds) in Building Safer Cities: The Future of Disaster Risk, The International Bank for Reconstruction and Development, The World Bank, Washington, DC, pp. 149-164.

Broaddus, A. (2007), 16/04/2007-last update*, Europe Plans for Sustainable 'Transport Tomorrow* [Homepage of Planetizen], [Online]. Available: www.planetizen.com/node/23872 [2009, 05/12].

Brewer, Gary and Peter de Leon "The Foundation of Policy Analysis". In Paul a Sabatier. (ed.), *Theories of the Policy Process*, Colorado: Westview Press.

Brown, D., S. Khagram, M. Moore and P. Frumkin (2000), "Globalization, NGOs, and Multi-Sector Governance," Working Paper #1 for the Hauser Center for Nonprofit Organizations and The Kennedy School of Government, Harvard University, Cambridge (US).

Brown, Marilyn A., Frank Southworth, and Andrea Sarzynski (May 2008), "Shrinking the Carbon Footprint of Metropolitan America," Blueprint for American Prosperity: Unleashing the Potential of a Metropolitan Nation, Washington, D.C.: Metropolitan Policy Program, Brookings Institution.

Brown, Paul (2005), "US cities snub Bush and sign up to Kyoto: Dozens of mayors, representing more than 25 million Americans, pledge to cut greenhouse gases", *The Guardian,* 17 May. .

Brunner, Ronald D. (1996), "Policy and global change research: a modest proposal", *Climatic Change,* Vol. 32, pp.121‐147.

Bulkeley, H. and K. Kern (2006), "Local Government and the Governing of Climate Change in Germany and the UK", *Urban Studies,* Vol. 43, No. 12, pp. 2237-2259.

Bulkeley, H. and S. C. Moser (2007), "Responding to Climate Change: Governance and Social Action beyond Kyoto." *Global Environmental Politics,* Vol. 7.2 pp. 1-10.

Bulkeley, H. and M. Betsill (2003), *Cities and Climate Change*: Urban Sustainability and Global Environmental Governance, Routeledge, London.

Bulkeley, Harriet and Heike Schroeder (2008), *Governing Climate Change Post-2012*: The Role of Global Cities – London, Tyndall Center for Climate change research

Bulkeley, Harriet and Heike Schroeder (2008), *Governing Climate Change Post-2012*: The Role of Global Cities Case-Study: Los Angeles, Tyndall Center for Climate change research

Bulkeley, Harriet, and Michele M. Betsill (2005), "Rethinking Sustainable Cities: Multilevel Governance and the 'Urban' Politics of Climate Change", *Environmental Politics,* Vol. 14 No.1, pp.42‐63.

Burby, Raymond (2003), "Making Plans That Matter - Citizen Involvement and Government Action." *Journal of the American Planning Association,* Vol.69, No. 1 pp. 33-49 Bulkeley, H., Betsill, M., (2003), "Cities and Climate Change: Urban sustainability and Global Environmental Governance," Routledge, London.

Burchell, R.W., G. Lowenstein, W. R. Dolphin, C.C. Galley, A. Downs, S. Seskin, K.G.Still and T. Moore (2002), TCRP Report 74: "Costs of Sprawl – 2000", Transportation Research Board, National Research Council, Washington, D.C.

Burniaux, J-M., J. Chateau, R. Duval and S. Jamet (2008), "The Economics of Climate Change Mitigation:Policies and Options for the Future", *OECD Economics Department Working Papers,* No. 658.

C-40 Cities 2008*, Freiburg – an inspirational city powered by solar, where a third of all journeys are by bike* [Homepage of C-40 Cities], [Online]. Available: Freiburg – an inspirational city powered by solar, where a third of all journeys are by bike. accessed 12 May 2009.

Capoor, K. and P.Ambrosi (2008), *State and Trends of the Carbon Market 2008,* World Bank, Washington, DC.

Cash, David W. and Susanne C. Moser (2000), "Linking global and local scales: designing dynamic assessment and management processes", *Global Environmental Change,* Vol.10 No. 2, pp.109‑120.

CCAR (2006), San Francisco first city in U.S. to certify greenhouse gas emissions. Los Angeles: California Climate Action Registry.

CCSR (2009), *Climate Impacts* [Homepage of Center for Climate Systems Research], [Online]. Available: http://ccsr.columbia.edu/cig/index.html, accessed 21 July 2009.

CEC (California Energy Commission) (2008), *Climate Change Research, Development, and Demonstration Plan*, *www.energy.ca.gov/pier/project_reports/500-03-025fs.html,* accessed 16 October 2008.

CEC (2008b), *Public Interest Energy Research (PIER) Program (2007) Annual Report*, *www.energy.ca.gov/2008publications/CEC-500-2008-026/CEC-500-2008-026-CMF.PDF.,* accessed 20 October 2008.

Chasek, S. (2000), *The Global Environment in the Twenty-first Century*: Prospects for International Cooperation, United Nations University Press, New York.

Chicago Climate Action Plan 2008, Adaptation, Available: www.chicagoclimateaction.org/filebin/pdf/finalreport/Adaptation.pdf, accessed November 25, 2008.

Cifuentes, L.A., E. Sauma, H. Jorquera, and F. Soto (1999), "Co-controls Benefits Analysis for Chile: Preliminary estimation of the potential co-control benefits for Chile", *COP-5 Progress Report,* School of Engineering, Pontifical Catholic University of Chile, October, revised 12 November

City of Cape Town (2006a), *Cape Town Energy and Climate Change Strategy,* Environmental Planning Department.

City of Cape Town (2006b), *Current Public Transport Record,* Department of Transport.

City of New York (2009), *PLANYC: Progress Report 2009 - A Greener, Greater New York,* New York City, New York.

City of Portland Bureau of Planning and Sustainability (2009a), 2009-last update*, City of Portland Proposed High Performance Green Building Policy* [Homepage of City of Portland], [Online]. Available: http://www.portlandonline.com/OSD/index.cfm?c=45879, accessed 22 March 2009.

City of Portland Bureau of Planning and Sustainability (2009b), 2009-last update, *The City of Portland's Green Building Program* [Homepage of City of Portland], [Online]. Available: http://www.portlandonline.com/osd/index.cfm?c=41481, accessed 22 March 2009.

City of Portland Bureau of Planning and Sustainability (2009c), 2009-last update, *Green Investment Fund* [Homepage of City of Portland], [Online]. Available: http://www.portlandonline.com/OSD/index.cfm?c=42134, accessed 22 March 2009.

City of Tokyo (2008), *Introduction of Tokyo's mandatory cap & trade system*, Tokyo Metropolitan Government.

Climate Impacts Group, King County, Washington, and ICLEI – Local Governments for Sustainability (2007), *Preparing for Climate Change*: A Guidebook for Local, Regional, and State Governments, The Climate Impacts Group, King County, Washington, and ICLEI – Local Governments for Sustainability, King County, Washington, USA.

Clinton Foundation (2009), "Clinton Climate Initiative," www.clintonfoundation.org/what-we-do/, accessed 22 January.

Cochran, Ian (2009), "Transport Infrastructures in France : Climate Change Vulnerabilities and Adaptation Possibilities," *Climate Report* No.15, Mission Climat de la Caisse des Dépôts.

Cohen, Ronnie, Barry Nelson, and Gary Wolff (2004a), *Energy Down the Drain*. New York: Natural Resources Defense Council, Pacific Institute.

Corburn, J. (2009), Cities, *Climate Change and Urban Heat Island Mitigation*: Localizing Global Environmental Science, Urban Studies, Vol. 46, No. 2, pp. 413-427.

Corfee-Morlot, J., I. Cochran and P. Teasdale (2009), "Cities and Climate Change: Harnessing the Potential for Local Action," *Competitive Cities and Climate Change,* OECD, Paris, pp. 78.

Corfee-Morlot, J. (2009), *California in the Greenhouse: Regional Climate Change Policies and the Global Environment,* PhD dissertation, Geography Department, University College London, London.

Corfee-Morlot, J. and P. Schwengels (1994), "Verification, Evaluation and Monitoring" in Katscher W. *et al.*, (eds.) *Greenhouse Gas Verification -- Why, How and How Much?* Proceedings of a Workshop, Forschungszentrum, Juelich.

Corfee‐Morlot, J., M. Maslin and J. Burgess (2007), "Global warming in the public sphere", *Philosophical Transactions of the Royal Society* ‐ Ser A 365 (1860):pp. 2741‐2776.

Council of European Municipalities and Regions (CEMR) (2009), www.cemr.org, accessed 11 February 2009.

Crass, Mary (2009), *Reducing CO2 emissions from urban travel*: local policies and national plans, international transport forum. Competitive Cities and Climate Change, 9-10 October 2008, Milan, Italy, Proceedings available at: www.oecd.org/dataoecd/12/38/42554913.pdf

Creutzig, F. and D. He (2009), "Climate change mitigation and co-benefits of feasible transport demand policies in Beijing", *Transportation Research Part D: Transport and Environment,* Vol. 14, No. 2, pp. 120-131.

Cunha, K.B. and F. Rei (2006), *Sub-national climate-friendly governance initiatives in developing world: a case study of State of São Paulo* – Brazil, Institute for Energy and Environment, Sao Paulo.

Cutter, S. L. (1996), "Vulnerability to Environmental Hazards." *Progress in Human Geography,* Vol. 20, No. 4.

Deangelo, B. J. and L. D. D. Harvey (1998), "The jurisdictional framework for municipal action to reduce greenhouse gas emissions: Case studies from Canada, the USA and Germany." *Local Environment,* Vol. 3.2 pp. 111-136.

Department of the Environment and Housing (2008), *The Catalan Office for Climate Change*, Government of Catalonia, Barcelona, ediambient.gencat.cat/eng//el_medi/C_climatic/occa.jsp, accessed 12 November 2009.

Dietz, T., E. Ostrom and P.C. Stern (2003), "The Struggle to Govern the Commons", *Science,* Vol. 302, pp.1907‐1912.

Dollar, David (2008), "Lessons from China for Africa," *World Bank Policy Research Working Paper* 4531, page 19

Dolowitz D P and D. Medearis (2009), "Considerations of the obstacles and opportunities to formalizing cross-national policy transfer to the United States: a case study of the transfer of urban environmental and planning policies from Germany" Environment and Planning C: Government and Policy advance online publication Economist, The (1999), "The Non-Governmental Order: Will NGOs Democratize, or Merely Disrupt, Global Governance?," Global Policy Forum, December 11-17.

EDAW (2008), *Case Study: Portland Green Investment Fund,* City of Seattle, Seattle.

Eichhorst, U. and D. Bongardt (2009), "Towards cooperative policy approaches in China — Drivers for voluntary agreements on industrial energy efficiency in Nanjing," *Energy Policy,* Vol. 37, pp. 1855-1865.

Embassy of Brazil in London (2007)*, Climate Change policy*. Available: http://www.brazil.org.uk/environment/climatechange.html, accessed 30 April 2009.

Energie-cités *et al.* (1999), "Solar Thermal Energy", Freiburg (Germany). Case study. www.energie-cites.eu/db/freiburg-im-breisgau_139_en.pdf.

Energie-cités *et al.* (2003), « La marche à pied en ville », Freiburg im Breisgau (DE). Case study. www.energie-cites.eu/db/freiburg-im-breisgau_562_fr.pdf, accessed 05 May 2009.

EUROCITIES (2009), www.eurocities.org, accessed 11 February 2009.

European Commission (2007), "Green Paper. Toward a New Culture for Urban Mobility," Brussels 25.9.2007 COM(2007)551final, SEC(2007)1209.

European Commission (2009), *Actions to Support Asia's Environment*. Available: http://ec.europa.eu/europeaid/where/asia/regional-cooperation/environment/index_en.htm, accessed 16 April 2009.

European Environment Agency (2009), CSI 011 –Greenhouse gas Emission Projections –Assessment Published March 2009, themes.eea.europa.eu/IMS/IMS/ISpecs/ISpecification20041007131701/IAssessment1224677156257

Evin C. and F. d'Aubert (2004), *Rapport de la Commission d'Enquête de l'Assemblée Nationale sur les conséquences sanitaires et sociales de la canicule. Le drame de la canicule: une gestion déficiente révélatrice d'une crise structurelle*. No. 1455, 25 February 2004.

Ewing, Richard, Rolf Pendall and Don Chen (2002), "Measuring Sprawl and its Impact." Smart Growth America, www.smartgrowthamerica.org/sprawlindex/MeasuringSprawl.PDF, accessed 05 May 2009.

Fairhead, James and Melissa Leach (2003), *Science, Society and Power: Environmental Knowledge and Policy in West Africa and the Caribbean,* Cambridge: Cambridge University Press.

Finnish Environment Institute (SKYKE) (2009), 2009-last update*, Climate Change Mitigation Project (SKYKE - CCM)* [Homepage of Ministry for the Environment], [Online]. Available: http://www.environment.fi/default.asp?node=21848&lan=en, accessed 25 March 2009.

Franco, Guido *et al*. (2008), "Linking Climate Change Science with Policy in California", *Climatic Change*, Vol. 87. (Supplement 1), pp. S7-S20.

Freedonia Group (2006), "World Housing to 2011,"

Freeman, C., S. Littlewood and D. Whitney (1996), "Local Government and Emerging Models of Participation in the Local Agenda 21 Process," *Journal of Environmental Planning and Management,* Vol. 39, No. 1, pp. 65-78.

Frumkin, H. (2002), "Urban Sprawl and Public Health." *U.S. Department of Health and Human Services: Public Health Reports.* Vol. 117 pp. 201-217.

Gallivan, Frank, Jeffrey Ang-Olson, William Schroeer and Frank Mongioi, Jr., ICF International (2007), "The Role of TDM and Other Transportation Strategies in State Climate Change Action Plans," *TDM Review,* Issue 2, pp. 10-14.

GLA (2007), *Action today to protect tomorrow: the Mayor's Climate Change Action Plan,* Greater London Authority, London, February

Globe International (2009), www.globeinternational.org, accessed 14 February 2009.

Gough, C. and S. Shackley (2001), "The respectable politics of climate change: the epistemic communities and NGOS," *International Affairs,* 77 (2):329-346.

Government of Catalonia (2008), "Catalonia's policy on climate change", *Europe's World*, No. 9 (Summer 2008), pp. 170-173, Brussels.

Government of Finland (2006), *Finland's Fourth National Communication under the United Nations Framework Convention on Climate Change,* Hämeen Kirjapaino Oy, Tampere.

Government of Japan (2008), *Action Plan for Achieving a Low-carbon Society*, www.kantei.go.jp/foreign/policy/ondanka/final080729.pdf

Government of New Zealand (2005), *Rules of New Zealand Local Government Association Inc. (trading as Local Government New Zealand),* Local Government New Zealand, Wellington, 199

Granberg, M. and I. Elander (2007), "'Local Governance and Climate Change: Reflections on the Swedish Experience," *Local Environment,* Vol. 12, No. 5, pp. 537-548.

Gray, Virginia. (1973), *Innovation in the States: A Diffusion Study*. The American Political Science Review 67 (4):1174.

Grindle, M. and J. Thomas (1991), *Public Choices and Policy Change: The Political Economy of Reform in Developing Countries,* Johns Hopkins University Press, London, UK.

Groven, K. and C. Aall (2002), *Lokal klima- og energiplanlegging. Norske kommuner som aktørar Iklimapolitikken*, Report 12/02, (Sogndal, Vestlandsforsking), Available with English summary at www.vestforsk.no/dok/samandrag/r12-02.htm.

Gupta, S., D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo and A. Sari (2007), "Policies, Instruments and Co-operative Arrangements," in: *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, UK.

Haas, P., Robert O. Keohane and Marc A. Levy, (eds.) (1993), *Institutions for the Earth*. Cambridge, MA: The MIT Press.

Habermas, Juergen (1998), *Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy,* Cambridge, MA: The MIT Press.

Hallegatte, S. (2006), "A Cost-Benefit Analysis of the New Orleans Flood Protection System," *Regulatory Analysis,* AEI-Brookings Joint Center, pp. 06-02.

Hallegatte, S., F. Henriet and J. Corfee-Morlot (2008), "The Economics of Climate Change Impacts and Policy Benefits at City Scale: A Conceptual Framework," OECD Environment Working Paper 4, ENV/WKP(2008)3, Paris, OECD.

Hallegatte, N., O. Patmore, P. Mestre, P., Dumas, J., Corfee-Morlot, C. Herweijer, and R. Muir Wood (2008), "Assessing Climate Change Impacts, Sea Level Rise and Storm Surge Risk in Port Cities: A Case Study on Copenhagen," OECD Environment Working Paper 3, Paris, OECD.

Hansen, J.E. (2007), "Scientific reticence and sea level rise", *Environment Research Letters,* 2, 024002.

Harris, Paul G. (2001), "Assessing Climate Change: International Co-operation and Predictions of Environmental Change", *Politics,* Oxford Vol. 21, No. 1, pp.11-22.

Hayhoe, K. *et al.* (2004), "Emissions pathways, climate change, and impacts on California", *Proceedings of the National Academy of Sciences,* Vol. 101, No. 34, pp.12422‑12427.

Healy, Patsy (1997), *Collaborative Planning: Shaping Places in Fragmented Societies.* London, Macmillan Press Ltd.

Heinz, Werner (2005), "Europe and German Cities," *German Institute of Urban Affairs,* Vol. 44, No. 2.

Holgate, C. (2007), "Factors and Actors in Climate Change Mitigation: A Tale of Two South African Cities," *Local Environment,* Vol. 12 No. 5, pp. 471-484.

Homes and Communities Agency (2009), *Eco-towns: Freiburg (Germany), Leading environmental policy and best practice.* Case study. URL: showcase.hcaacademy.co.uk/case-study/ecotowns-freiburg-germany.html. Accessed 12 May 2009.

Hooghe, L. and G. Marks (2003), "Unravelling the Central State, but How? Types of Multi-level governance", *American Political Science Review,* Vol. 97, No. 2, pp.233-43.

Hunt, A. and P. Watkiss (2007), "Literature Review on Climate Change Impacts on Urban City Centres: Initial Findings," OECD, Paris.

ICLEI (2007), *Local Renewables Model Communities Network in Brazil - REDE ELo* [Homepage of ICLEI], [Online]. Available: http://www.iclei.org/uploads/media/ELo_Brazil_Bali_LR2007.pdf accessed 27 April 2009.

ICLEI (2009), "Local Action Moves the World," www.iclei-usa.org/about-iclei, accessed 9 February 2009.

ICLEI (2009), "Local Government Climate Roadmap, European forum, 10 February 2009," www.globalclimateagreement.com, accessed 12 February 2009.

ICLEI (2009), "The relevance of cities to the UN Climate Change Conference in Poland," Post Carbon Cities Newsfeed, postcarboncities.net/node/3992, accessed 11 February 2009.

ICLEI Europe (2009), *Finland* [Homepage of ICLEI], [Online]. Available: http://www.iclei-europe.org/index.php?id=601, accessed 15 April 2009.

ICLEI (Local Governments for Sustainability) (2009), "Partners of the Local Government Climate Roadmap," www.iclei.org/index.php?id=7925, accessed 24 January 2009.

ICLEI—Local Governments for Sustainability (1995), "Third Local Government Leaders' Declaration on Climate Change: The Saitama Declaration," ICLEI—Local Governments for Sustainability Third Municipal Leaders' Summit on Climate Change, Saitama, Japan, October.

ICLEI Oceania (2008), *New Zealand Supplement to the International Local Government GHG Emissions Analysis Protocol,* Wellington.

International Energy Agency (2007), *World Energy Outlook*, OECD/IEA, Paris, France.

International Energy Agency (2007), *Renewables for Heating and Cooling*, OECD/IEA, Paris, France.

International Energy Agency (2008), *World Energy Outlook*, OECD/IEA, Paris, France.

IPCC (1996), "Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses," Contribution of Working Group, Second Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC (2007a), "Summary for Policy Makers", Climate Change 2007: Synthesis Report. Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK and New York, USA, Cambridge University Press.

IPCC (2007b), *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.), Cambridge, UK and New York, USA, Cambridge University Press.

IPCC (2007c), *Climate Change 2007: Mitigation of Climate Change,* Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK and New York, USA, Cambridge University Press.

IRI (2009), *The International Research Institute for Climate and Society*, accessed 12 November 2009, *http://portal.iri.columbia.edu/portal/server.pt*.

IRI (2009), *IRI Projects*, accessed 16 October 2008, *http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=967&mode=2*.

ISO, 2007, ISO 14065:2007, www.iso.org, accessed 27 February 2009.

Jacobs, Michael (1994), "The Limits to Neoclassicism: Towards an Institutional Environmental Economics," in: *Social Theory and the Global Environment,* edited by M. Redclift and T. Benton, London and New York, Routledge.

Jamet S. and J. Corfee-Morlot (2009), "Assessing the Impacts of Climate Change: A Literature Review", *OECD Economics Department Working Paper*, Paris, forthcoming.

Japan for Sustainability (2008), "Local Governments' Goals and Measures in Anti-Global Warming Campaigns," *JFS Newsletter,* No.70. Available: http://www.japanfs.org/en_/public/gov_21.html accessed 20 April 2009.

Jasanoff, Sheila (1998), "Contingent Knowledge: Implications for Implementation and Compliance," in: *Engaging Countries: Strengthening Implementation and Compliance,* edited by E. W. Brown and H. Jacobsen. Cambridge, MA: MIT Press.

Johansson P. A. Nylander and F. Johnsson (2006), "Electricity dependency and CO2 emissions from heating in the Swedish building sector—Current trends in conflict with governmental policy?", *Energy Policy,* Vol. 34, pp. 3044-3069.

Jones, Charles (1970), "Introduction to the Study of Public Policy," in: *Theories of the Policy Process,* Paul A. Sabatier. (ed.), Colorado: Westview Press.

Jones, Huw (July 25, 2008), "Top EU Court Backs Citizen Rights in Air Pollution" Reuters.

Kaldor, M. (2003), "The Idea of Global Civil Society," *International Affairs,* Vol. 79, No. 3, pp. 583-593.

Keiner, M. and A. Kim (2006), "Transnational City Networks for Sustainability," *European Planning Studies,* Vol. 15, No. 10, pp. 1369-95.

Kern, K. and A. Gotelind (2009), "Governing Climate Change in Cities: Modes of Urban Climate Governance in Multi-level Systems", (ed.) OECD, OECD Conference Proceedings, Paris, pp. 171.

Kern, K. *et al.* (2005), *Kommunaler Klimaschutz in Deutschland – Handlungsmöglichkeiten, Entwicklung und Perspektiven*, Wissenschaftszentrum Berlin, DP SP IV 2005-101, skylla.wz-berlin.de/pdf/2005/iv05-101.pdf

Knowlton, K. , B. Lynn, R. A. Goldberg, C. Rosenzweig, C. Hogrefe, J. Klein Rosenthal and P. L. Kinney (2007), "Protecting Heat-Related Mortality Impacts Under a Changing Climate in the New York City Region," *American Journal Of Public Health,* Vol. 97, pp. 2028-2034.

Kunzli, N. R. Kaiser, S. Medina, M. Studnicka, O.Chanel, P. Filliger, M. Herry, F. Horak Jr., V. Puybonnieux-Texler, P. Quénel, J. Schneider, R. Seethaler, J-C Vergnaud and H. Sommer (2000), "Public Health Impact of Outdoor and Traffic Related Air Pollution: a European Assessment", *The Lancet,* Vol. 356, September 2, 2000

Kunzmann, Klaus R. (2001), "State Planning: A German Success Story?" *International Planning Studies,* Vol. 6, No. 2, pp. 153-167

Kyoto Local Agenda 21, *Community-Based Climate Change Prevention in Kyoto*. Available: http://ma21f.jp/english.html, accessed 20 April 2009.

Laigle, L. (2009), Vers des villes durables: Les trajectoires de quatre agglomérations européennes, PUCA (ed.), Ministère de l'Écologie, du Développement et de l'Aménagement Durables, Paris.

Leiserowitz, Anthony A. (2005), "American Risk Perceptions: Is Climate Change Dangerous?" *Risk Analysis,* Vol. 25, No. 6.

Leseur, A., Mansanet-Bataller, H. Mignucci and I. Cochran (2009), "The importance of adapting to climate change in French urban areas: Examples from energy and transportation infrastructures", *IOP Conference Series: Earth Environmental Science*, Vol. 6, ref. 332014.

Levy, David L. and Peter J. Newell. (eds.) (2005), *The Business of Global Environmental Governance*. Cambridge, MA and London: MIT Press.

Lindseth, G. (2006), *Political Discourse and Climate Change: The Challenge of Reconciling Scale of Impact with Level of Governance,* thesis, Department of Sociology and Political Science, Norwegian University of Science and Technology, Trondheim (Norway).

Lindseth, Gard (2004), "The Cities for Climate Protection Campaign (CCPC) and the Framing of Local Climate Policy," *Local Environment,* Vol. 9, No. 4, pp. 325-336.

Liverman, D., and K. O'Brien. (2001), "Southern Skies: The Perception and Management of Global Environmental Risks in Mexico," in: *Learning to Manage Global Environmental Risks: A Comparative History of Climate Change, Ozone Depletion and Acid Rain,* edited by The Social Learning Group. Cambridge, MA: MIT Press.

Local and Regional Government Finland (2008), *How Finnish local authorities can slow down and adapt to climate change – Policy guidelines by the Association of Finnish Local and Regional Authorities (AFLRA),* ALFRA.

Local Government New Zealand (2008), *Annual Report 2007/08*, Local Government New Zealand, Wellington.

London Metropolitan Government. (2002), "London's Warming: The Impacts of Climate Change on London", Summary Report. www.london.gov.uk/gla/publications/environment/londons_warming02.pdf, accessed 12 May 2009

Löwe, H., G. Seufert and F. Raes (2000), "Comparison of methods used within Member States for estimating CO2 emissions and sinks according to UNFCCC and EU Monitoring Mechanism: forest and other wooded land," *Biotechnology, Agronomy, Society and Environment,* Vol. 4, No. 4, pp. 315-319, European Commission: Joint Research Centre, (Environment institute), Ispra (Italy).

Mairie de Paris (2007), *Paris Climate Protection Plan,* Paris

Mansanet-Bataller, M., M. Hervé-Mignucci and A. Leseur (2008), "Energy Infrastructures in France: Climate Change Vulnerabilities and Adaptation Possibilities," *Mission Climat Woking Papers,* No. 2008-1, Mission Climat de la Caisse des Dépôts.

Marks, G. (1993), "Structural Policy and Multilevel Governance in the EC," in: *The State of the European Community Vol. 2: The Maastricht Debates and Beyond*, Alan Cafruny and Glenda Rosenthal (eds.) pp. 391-410, Boulder: Lynne Rienner.

Mathew, R. A. (2007), "Climate Change and Human Security," in: *Climate Change: What It Means for Us, Our Children, and Our Grandchildren,* edited by J. F. C. DiMento and P. Doughman. Cambridge, MA: MIT Press.

Matthews, Karine and Matthew Paterson (2005), "Boom or Bust? The Economic Engine Behind the Drive for Climate Change Policy." *Global Change, Peace & Security,* Vol. 17.1 pp. 59-75.

Mazmanian, Daniel A., John Jurewitz, and Hal Nelson. (2008), "California's Climate Change Policy: The Case of a Subnational State Actor Tackling Climate Change," *The Journal of Environment and Development,* Vol. 17, No. 4, pp. 401-23.

McEvoy, D., S. Lindley and J. Handley (2006), "Adaptation and mitigation in urban areas: synergies and conflicts," *Proceedings of the Institution of Civil Engineers – Municipal Engineer,* Vol. 159, No. 4, pp. 185-191.

McGann, J. and M. Johnstone (2005), "The Power Shift and the Ngo Credibility Crisis," *Brown Journal of World Affairs,* Vol.11, No. 2, pp. 159-172.

McGranahan, G. and P. Marcotullio (2006), "Chapter 27: Urban Systems," in: *Ecosystems and Human Well-being: Current State and Trends, Millennium Ecosystem Assessment,* Island Press, Washington DC, pp. 795–825.

McKenzie Hedger, Merylyn; Connell, Richenda; Bramwell, Penny, (2006), "Bridging the gap: empowering decision-making for adaptation through the UK Climate Impacts Programme," *Climate Policy*, Vol. 6 No. 2, pp. 201-215.

McKinsey & Company and The Conference Board (2007), *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* U.S. Greenhouse Gas Abatement Mapping Initiative, Executive Report. December 2007. Available at: www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.

Mehrotra, S., C.E. Natenzon, A. Omojola, R. Folorunsho, J. Gilbride and C. Rosenzweig (2009), "Framework for City Climate Risk Assessment", paper presented at the Fifth Urban Research Symposium, Marseille, France, June 28-30, 2009.

Metropolitan Washington Council of Governments (2008), *National Capital Region Climate Change Report.* Available at: www.mwcog.org/uploads/pub-documents/zldXXg20081203113034.pdf

Miami Dade County Climate Change Advisory Task Force (2008), Second Report and Initial Recommendations Presented to The Miami-Dade Board of County Commissioners, Miami Dade County, Miami.

Mickley L. J., Jacob, D. J. Field, B. D. and D. Rind (2004), "Effects of future climate change on regional air pollution episodes in the United States," *Geophysical Research Letters,* Vol. 31, No. 24.

Ministry for the Environment (2009), *The Resource Management (Foreshore and Seabed) Amendment Act 2004: What It Means For Local Government*. Available: http://www.mfe.govt.nz/publications/rma/foreshore-seabed-dec04/foreshore-seabed-dec04.html, accessed 25 March 2009.

Ministry for the Environment (2005a), *New Zealand's Fourth National Communication*, Wellington.

Ministry for the Environment (2005b), *Review of Climate Change Policy*, Government of New Zealand.

Ministry of Environment (2008), *Guidelines for Environmental Representations (Eco-labelling)*.

Ministry of Sustainable Development (2005), *The Swedish Report on Demonstrable Progress*, Ministry publications series, Stockholm.

Ministry of the Environment (2009), 2009-last update*, Regional Environmental Centers* [Homepage of Ministry of the Environment], [Online]. Available: http://www.ymparisto.fi/default.asp?node=4661&lan=en, accessed 12 March 2009.

Molina, M.J., and L.T. Molina (2004), "Critical Review: Megacities and Atmospheric Pollution," *Journal of the Air Waste Management Association,* Vol. 54, No. 6, pp. 644-680.

Monni, S. and F. Raes (2008), "Multilevel climate policy: the case of the European Union, Finland and Helsinki", *Environmental Science and Policy,* Vol. 2, pp. 743-755.

Moser, S., and L. Dilling (eds.), (2007), *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change,* Cambridge University Press, Cambridge.

Moser, Susanne (2005), "Stakeholder Involvement in the First US National Assessment of the Potential Consequences of Climate Variability and Change: An Evaluation, Finally," paper read at Public Participation in Environmental Assessment and Decision Making, 2-5 February, 3-4 February, in Washington DC.

Mossberger, K. and H. Wolman, "Policy Transfer as a Form of Prospective Policy Evaluation," *Public Administration Review,* July/August, 2003, Vol. 63, No. 4, pp. 428-440.

Mossberger, Karen A. (2000), *The Politics of Ideas and the Spread of Enterprise Zones,* Washington DC: Georgetown University Press.

Motiva Oy (2008a), *Annual Review 2007*, Motiva.

Motiva Oy (2008b), 13.11.2008-last update*, Motiva Oy in Brief* [Homepage of Motiva Oy], [Online]. Available: http://www.motiva.fi/en/motivaoy/motivainbrief/, accessed 12 March 2009.

Mukheibir, P and G. Ziervogel (2007), "Developing a Municipal Adaptation Plan (MAP) for climate change: the city of Cape Town," *Environment & Urbanisation*, Vol. 19 No. 1, pp. 143-158. April 2007

Nelson, Arthur C. and James Duncan (1995), *Growth Management Principles and Practices,* Chicago, American Planning Association.

New York City Department of Environmental Protection Climate Change Program (2008), *Assessment and Action Plan: A Report Based on the Ongoing Work of the DEP Climate Change Task Force,* The City of New York, May 2008.

Newell, Peter (2000), *Climate for Change: Non-state Actors and the Global Politics of the Greenhouse,* Cambridge: Cambridge University Press.

Nicholls, R., S. Hanson, C. Herweijer, N. Patmore, J. Corfee‑Morlot, J. Chateau and R. Muir‑Wood (2008), "Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes," OECD Environment Working Papers No. 1, OECD, Paris.

Nicholls, R., S.Hanson, C. Herweijer, N, Patmore, S. Hallegatte, J. Corfee-Morlot, J. Chateau and R. Muir-Wood (2007), "Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Exposure Estimates," OECD Environment Working Paper 1, Paris, OECD.

NPCC (2009), *Climate Risk Information, New York City Panel on Climate Change,* New York.

Nykvist, B. and L. Whitmarsh (2008), "A multi-level analysis of sustainable mobility transitions: Niche development in the UK and Sweden," *Technological Forecasting & Social Change,* Vol. 75, pp. 1373-1387.

OECD (1999), *Urban Policy in Germany*: *Towards Sustainable Urban Development*. OECD, Paris, France

OECD (2000), *Ancillary Benefits and Costs of Greenhouse Gas Mitigation*, OECD, Paris.

OECD (2005), *Building Competitive Regions*: *Strategies and Governance,* OECD, Paris.

OECD (2006a), *Competitive Cities in the Global Economy,* OECD, Paris.

OECD (2006b), "Declaration on Integrating Climate Change Adaptation into Development Co-Operation," statement adopted by the Development and Environment Ministers of OECD member countries, 4 April 2006, Paris.

OECD (2007a), *Linking Regions and Central Governments: Contracts for Regional Development,* OECD, Paris.

OECD (2007b), *Observer,* No. 260, March 2007.

OECD (2008), *OECD Environmental Outlook to 2030*, Paris.

OECD (2008a), "Briefing Note: Local Governments and the UN Climate Negotiations," mimeo.

OECD (2008b), "Cities Should Tackle Climate Change to Stay Competitive," Milan, Italy, www.oecd.org/dataoecd/62/60/41459089.pdf.

OECD (2008c), "Mayors, Ministers call for Joint Action on Climate Change at OECD Conference," 10 October.

OECD (2008e), *Territorial Review of Cape Town,* OECD, Paris.

OECD (2008f), "Governing Climate Change in Cities: Modes of Urban Climate Governance in Multi-level Systems," presentation prepared for OECD International Conference *Competitive Cities and Climate Change*, October 9-10, 2008, Milan.

OECD (2009a), *Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012,* OECD, Paris.

OECD (2009b), "Investing for Growth: Building innovative regions, Ministerial Background report", Meeting of the Territorial Development Policy Committee (TDPC) at Ministerial level, 31 March 2009.

OECD (2009c), *Governing Regional Development Policy: The Use of Performance Indicators,* 24 March 2009, OECD, Paris.

OECD (2009d), "Governing Climate Change in Cities: Modes of Urban Climate governance in Multi-level systems", *Competitive Cities and Climate Change: OECD Conference Proceedings*, 9-10 October 2008, Milan, Italy, Proceedings available at: www.oecd.org/dataoecd/12/38/42554913.pdf.

OECD (2009e), *Green Cities: New Approaches to Confronting Climate Change, OECD Workshop Proceedings,* 11 June 2009, Las Palmas de Gran Canaria, Spain.

OECD (2009f), *Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation,* OECD, Paris.

OECD (2010), forthcoming, "Mumbai, Climate Change and Future Flood Risk: Exposure, Economic Losses and Adaptation Options", [working title], OECD, Paris.

Oke TR (1987), *Boundary layer climates*. Cambridge University Press, Cambridge.

Oregon Best (2008), 2008-last update*, An Economic Engine for Oregon* [Homepage of Oregon Best], [Online]. Available: http://oregonbest.org/, accessed 23 March 2009.

Oregon Housing and Community Services (2009), 2009-last update*, Building Codes Division: Green Building Services* [Homepage of OHCS], [Online]. Available: http://www.cbs.state.or.us/external/bcd/programs/green.html, accessed 20 March 2009.

Oregon Housing and Community Services (2002), *Green Building Source Guide*, OHCS, Portland.

Oregon Metro (2009), Urban Growth Boundary. www.oregonmetro.gov/index.cfm/go/by.web/id=277, accessed on 12 May 2009

Ostrom, E. (1990), *Governing the Commons: The Evolution of Institutions for Collective Action,* Cambridge: Cambridge University Press.

Ostrom, Elinor (2000), "Collective Actions and the Evolution of Norms," *Journal of Economic Perspectives,* Vol. 14, No. 3, pp.137-158.

Ostrom, Elinor, Thomas Dietz, Nives Dolsak, Paul C Stern, Susan Stonich, and Elke Weber, (eds.) (2002), *The Drama of the Commons*. Washington, D.C.: National Academy Press.

Ouranos (2008), *Consortium on Regional Climatology and Adaptation to Climate Change*, accessed 20 October 2008, *www.ouranos.ca/doc/Ouranos_broc_eng.pdf*.

Ouranos (2008b), *Ouranos Mission*, accessed 20 October 2008, *www.ouranos.ca/intro/miss_e.html*.

Oxfam (2008), *Oxfam analysis of the Poznan Conference outcomes,* www.oxfam.org, accessed 26 February 2009.

Parson, E. A *et al.*, (2003), "Understanding Climatic Impacts, Vulnerabilities, and Adaptation in the United States: Building a Capacity for Assessment," *Climatic Change,* Vol. 57 No. 1‐2, pp.9‐42.

Paterson, M. (2008), "Global governance for sustainable capitalism: political economy and environmental governance," in: *Governing Sustainability,* edited by N. Adger and A. Jordon. Cambridge, UK: Cambridge University Press.

Paterson, Matthew, David Humphreys, and Lloyd Pettiford (2003), "Conceptualizing Global Environmental Governance: From Interstate Regimes to Counter-Hegemonic Struggles," *Global Environmental Politics,* Vol. 3, No. 2, pp.1-10.

Peterson, Thomas D., Robert B. McKinstry, Jr., and John C. Dernbach (2008), "Developing a Comprehensive Approach to Climate Change Policy in the United States that Fully Integrates Levels of Government and Economic Sectors," *Virginia Environmental Law Journal,* Vol. 26, pp. 219-61.

Pew Center on Global Climate Change (2004), *Learning from State Action on Climate Change.*

Puppim de Oliveira, J.A. (2009), "The implementation of climate change related policies at the subnational level: An analysis of three countries," *Habitat International,* Vol. 33, N. 3, pp. 253-259.

Rabe, Barry (2004), *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy,* Washington, D.C.: Brookings Institution Press.

Rabe, Barry (2009), "Governing the Climate from Sacramento," in Stephen Goldsmith and Donald Kettl, (eds.), *Unlocking the Power of Networks: Keys to High-Performance Government,* Washington, D.C.: Brookings Institution Press.

Rahmstorf, Stefan (2007), "Sea‐Level Rise A Semi‐Empirical Approach to Projecting Future", *Science,* 315, 368–370, DOI: 10.1126, science.1135456.

Rich, D. (2008), "Climate and Energy," *Policy Series,* World Resource Institute, Washington.

Richardson, Jesse Jr., Meghan Zimmerman Gough and Robert Puentes (2003), "Is Home Rule The Answer? Clarifying The Influence Of Dillon's Rule On Growth Management." Discussion Paper, The Brookings Institution Center on Urban and Metropolitan Policy Washington D.C.

Risse-Kappen, T., ed. (1995), *Bringing Transnational Relations Back In: Non-State Actors, Domestic Structures and International Institutions*, Cambridge, Cambridge University Press.

Roberts, G. (2008), *Carbon Trading Councils In Practice.* Local Government Information Unit, London.

Rojas, A. V. (2006), "Local Initiatives and Adaptation to Climate Change," *Disasters,* Blackwell Publishing, Oxford, Vol. 30, No. 1, pp. 140-147.

Rosenzweig, C., Major, D.C., Demon, K., Stanton, C., Horton, R. & Stults, M. (2007), "Managing climate change risks in New York City's water system: assessment and adaptation planning," *Mitigation and Adaptation Strategies for Global Change,* Vol. 12, pp. 1391-1409.

Rousseau, (2005), "Analyse fine des surmortalités pendant la canicule 2003: L'événement météorologique de la nuit du 11 au 12 août 2003 en Île-de-France," *La Météorologie,* ISSN 0026-1181, Nº. 51, 2005, pp. 16-22 (www.smf.asso.fr/Ressources/Rousseau51.pdf)

Ruth, M., and Gasper, R. (2008), "Water in the Urban Environment: Meeting the Challenges of a Changing Climate," paper submitted to the International Conference "Competitive Cities and Climate Change" 9-10 October 2008, Milan, Italy.

Rydin, Yvonne. (2003), *Conflict, Consensus, and Rationality in Environmental Planning: An Institutional Discourse Approach,* Oxford Geographical and Environmental Studies. Oxford: Oxford University Press.

Sathaye, J., A. Najam, C. Cocklin, T. Heller, F. Lecocq, J. Llanes-Regueiro, J. Pan, G. Petschel-Held , S. Rayner, J. Robinson, R. Schaeffer, Y. Sokona, R. Swart, and H. Winkler (2007), "Sustainable Development and Mitigation," in: *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds.), Cambridge, UK and New York, NY, USA: Cambridge University Press.

Satterthwaite, D. (2008). "Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions," *Environment and Urbanization,* 2008 20: 539-549

Schaer, P.L. Vidale, D. Lüthi, C. Frei, C. Häberli, M. Liniger and C. Appenzeller (2004), "The role of increasing temperature variability for European summer heat waves," *Nature,* No. 427, pp. 332-336, doi:10.1038/nature02300

Schreurs, M. (2008), "From the Bottom Up: Local and Subnational Climate Change Politics," *The Journal of Environment & Development,* Vol. 17, No. 4, pp. 343-355.

Schreurs, Miranda A. (2004), "The Climate Change Divide: The European Union, the United States, and the Future of the Kyoto Protocol," in: *Green Giants? Environmental Policy of the United States and the European Union,* Norman J. Vig and Michaele Faure, eds., (Cambridge, MA: MIT Press), pp. 207-30.

Schreurs, Miranda, A., Stacy D. VanDeveer and Henrik Selin, (2009b), "Conflict and Cooperation in Transatlantic Climate Politics: Different Stories at Different Levels," in: *Transatlantic Environment and Energy Politics,* Miranda Schreurs, Stacy D. VanDeveer and Henrik Selin, (Surrey, UK: Ashgate Publishing), pp. 165-88.

Schreurs, Miranda, A., Stacy D. VanDeveer and Henrik Selin, eds., (2009a), *TransAtlantic Energy and Environmental Politics: Comparative and International Perspectives,* Surrey, UK: Ashgate Publishing.

Schroeder, Heike and H Bulkeley (2009), "The importance of being partners: exploring horizontal and vertical interplay in urban climate governance," *IOP Conf. Series: Earth and Environmental Science* No. 6.

Selin, Henrik and Stacy D. VanDeveer (2005), "Canadian-U.S. Environmental Cooperation: Climate Change Networks and Regional Action," *The American Review of Canadian Studies,* Summer 2005, pp. 353-78.

Sellers, Jefferey M. "The Nation-State and Urban Governance: Toward Multilevel Analysis," *Urban Affairs Review,* Vol. 37 No.5 (2002): 611-641.

Shackley, S., and R. Deanwood. 2002. "Stakeholder Perceptions of Climate Change Impacts at the Regional Scale: Implications for the Effectiveness of Regional and Local Responses," *Journal of Environmental Planning and Management,* 45 (3):381-402.

Social Learning Group ed. (2001), Learning to Manage Global Environmental Risks: A Comparative History of Climate Change, Ozone Depletion and Acid Precipitation. 2 vols. Cambridge, MA: MIT Press.

State of Oregon (2004), *Oregon Strategy for Greenhouse Gas Reductions: Governor's Advisory Group On Global Warming,* State of Oregon.

Stern, N. (2006), *Stern Review on the Economics of Climate Change,* HM Treasury, London.

Stern, N. (2007), *The Economics of Climate Change: The Stern Review,* Cambridge, UK: Cambridge University Press.

Stern, Paul C. and Harvey V. Fineberg, (eds) (1996), *Understanding Risk: Informing Decisions in a Democratic Society,* National Academies Press, Washington D.C.

Stezer, J. (2009), *Subnational and Transnational Climate Change Governance: Evidence From the State and City of Sao Paulo, Brazil,* London School of Economics and Political Science, London.

Storbjörk, S. (2007), "Governing Climate Adaptation in the Local Arena: Challenges of Risk Management and Planning in Sweden," *Local Environment,* Vol. 12, No. 5, pp. 457-469.

Sugiyama, Noriko and Tsuneo Takeuchi (2008), "Local Policies for Climate Change in Japan," The *Journal of Environment and Development,* Vol. 17, No. 4, pp. 424-41.

Sujiyama, N. & Takeuchi, T. (2008), "Local Policies for Climate Change in Japan", *The Journal of Environment and Development,* vol. 17, no. 4, pp. 424-441.

Summerville, J. (2008), "Community Participation, Rights, and Responsibilities: The Governmentality of Sustainable Development Policy in Australia," *Environment and Planning C: Government and Policy,* Vol. 26 No. 4, pp. 696–711, Centre for Social Change Research, Queensland University of Technology, Queensland.

Sustainable Business News (2009), "Japan Launches First GHG Monitoring Satellite," www.sustainablebusiness.com/index.cfm/go/news.display/id/17553, accessed 15 February 2009.

Swedish Environmental Protection Agency (2009), 16/02/2009-last update*, Climate Investment Programmes (Klimp)* [Homepage of SEPA], [Online]. Available: http://www.naturvardsverket.se/en/In-English/Menu/Legislation-and-other-policy-instruments/Economic-instruments/Investment-Programmes/Climate-Investment-Programmes-Klimp/ [2009, 03/12] .

Swedish Environmental Protection Agency (2004), *Acheiving CLimate Targets*, SEPA.

Tanner, T., Mitchell, T., Polack, E., Guenther, B. (2009), "Urban Governance for Adaptation: Assessing Climate Change Resilience in Ten Asian Cities," Working Paper 315, Institute of Development Studies, Brighton, UK.

Tekes (2009), *Tekes Annual Review 2008* [Homepage of Tekes], [Online]. Available: http://www.tekes.fi/eng/tekes/annuals/annual2008/funding.html [2009, 04/15] .

TEKES (2008), 2008-last update*, Tekes: Programmes and Projects* [Homepage of TEKES], [Online]. Available: http://www.tekes.fi/eng/programmes/ [2009, 03/12] .

Teng, F. & Gu, A. (2007), "Climate change: national and local policy opportunities in China," *Journal of Integrative Environmental Sciences,* Vol. 4, No. 3, pp. 183 *seq*.

The Greenhouse Gas Protocol Initiative (GHG Protocol) (2009), www.ghgprotocol.org/about-ghgp, accessed 10 February 2009.

Tokyo Metropolitan Government, "Environmental White Paper 2006," Available at: www2.kankyo.metro.tokyo.jp/kouhou/env/eng/environment07.html.

Tokyo Metropolitain Government 2007, *Tokyo Climate Change Strategy*

Toronto Environment Office 2008, Ahead of the Storm: Preparing Toronto for Climate Change [Homepage of City of Toronto], [Online]. Available at: www.toronto.ca/teo/pdf/ahead_of_the_storm.pdf [2208, 11/25] .

Transport for London (2005), "Central London congestion charging, Impacts monitoring," Third 45 annual report, April.

U.S. Green Building Council (2009), www.usgbc.org. Accessed 30 March 2009.

UCLG (2009), *Local Government and Action on Climate Change in Poland,* www.cities-localgovernments.org/uclg, accessed 11 February 2009.

UKCIP (2005), program : UKCIP 2005-2010, www.ukcip.org.uk/images/stories/About_UKCIP/workprogrammeforag.pdf [2008, 10/17]

UKCIP (2008), *About UKCIP*, accessed 17 October 2008, *www.ukcip.org.uk/index.php?option=com_content&task=view&id=18&Itemid=123*.

UNDP (2003), *Human Development Report,* United Nations Development Programme, Oxford: Oxford University Press.

UNFCCC (2005), *Project Design Document Form (CDM PDD): Bandeirantes Landfill Gas to Energy Project (BLFGE)*, UNFCCC.

UNFCCC (2002), *Counting emissions and removals greenhouse gas inventories under the UNFCCC,* UNFCCC, Bonn.

UNFCCC (2009), *Bodies of the Convention and Partner Agencies,* unfccc.int/essential_background/feeling_the_heat/items/2915.php, accessed 11 February 2009.

United Nations, (2008), *World Urbanisation prospects,* 2007 revision.

United States Conference of Mayors (2007), *Climate Protection Strategies and Best Practices Guide,* The City of Seattle, November 1-2, 2007.

Vescovi, *et al.*, (2007), "Climate Change Science Knowledge Transfer in Support of Vulnerability, Impacts and Adaptation Activities on a North American Regional Scale: Ouranos as a Case Study," Regional Expert Meeting: *Meeting Report papers*. www.gulfofmaine.org/ESIPPlanning/subcommittees/climatechange/CCRefDocs/Vescovi.pdf [2008, 10/27] .

Vine, E., Sathaye, J. (1997), "The Monitoring, Evaluation, Reporting, and Verification of Climate Change Mitigation Projects: Discussion of Issues and Methodologies and Review of Existing Protocols and Guidelines" paper prepared for the U.S. Environmental Protection Agency.

Vogel, David. (1995), *Trading Up: Consumer and Environmental Regulations in a Global Economy*. Cambridge: Harvard University Press.

Voogt, J. A. (2002), "Urban heat island," in: *Encyclopedia of Global Environmental Change,* I. Douglas (Ed.) pp. 660–666. New York: John Wiley & Sons.

Walker, (1987), "Snow White and the 17 dwarfs: from metro cooperation to governance," *National Civic Review,* 76, pp. 14-28

Weidner, Helmut and Lutz Mez (2008), "German Climate Change Policy: A Success Story with Some Flaws," *The Journal of Environment and Development,* Vol. 17, No. 4, pp. 356-78.

Weiss, E. B. and H.K. Jacobson (1998), "Engaging countries: strengthening compliance with international environmental accords", *Global environmental accords*, Cambridge, Mass, MIT Press.

West, C. and & Gawith, M. (2005), "Measuring Progress: Preparing for Climate Change Through the UK Climate Impact Program" [Homepage of UKCIP Oxford], [Online]. www.ukcip.org.uk/images/stories/Pub_pdfs/MeasuringProgress.pdf [2008, 10/17] .

Wheeler, Stephen M. (2008), "State and Municipal Climate Change Plans", *Journal of American Planning Association,* Vol. 74, No. 4, pp. 481-96.

Wilbanks, T.J., P. Romero Lankao, M. Bao, F. Berkhout, S. Cairncross, J.-P. Ceron, M. Kapshe, R. Muir-Wood & R. Zapata-Marti, (2007), "Industry, settlement and society," in: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* Cambridge University Press, UK.

WMO/OMM (1988), "The Changing Atmosphere: Implications for Global Security," *Toronto Conference Proceedings: WMO/OMM,* pp. 710.

World Bank (2009), *Cities and Climate Change: Sharpening the Tools of Diagnosis and Dialogue,* World Bank, Washington D.C.

World Bank (2007), *Cost of Pollution in China: Economic Estimates of Physical Damages,* World Bank, Washington D.C.

World Business Council on Sustainable Development (WBCSD) (2009), "Energy and Climate," wbcsd.org, accessed 13 February 2009.

Ye Qi, Li Ma, Huanbo Zhang, and Huimin Li (2008), "Translating a Global Issue into Local Priority: China's Local Government Response to Climate Change," *The Journal of Environment and Development,* Vol. 17, No. 4, pp. 379-400.

Yin, Y. and S.J. Cohen (1994) "Identifying regional goals and policy concerns associated with global climate change", *Global Environmental Change,* Vol. 4 No. 3 pp. 246‑260.

Young, Oran R. 1989. *International Cooperation: Building Regimes for Natural Resources and the Environment,* Ithaca: Cornell University Press.

Yuan, H. 2007, "Implementation of voluntary agreements for energy efficiency in China", *Energy Policy,* Vol. 35, pp. 5541-5548.

Zaleski, O. 2009, China's Plastic Bag Ban Will Save 37 Million Barrels of Oil [Homepage of The Daily Green], [Online]. Available: www.thedailygreen.com/environmental-news/latest/china-plastic-bags-47010907 [2009, 05-05] .