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Preparing for a changing climate: The Chicago climate action plan's adaptation strategy

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ABSTRACT

The Chicago Climate Action Plan (CCAP), Chicago's roadmap for reducing climate change impacts and adapting to the changes already occurring, relied on rigorous analysis to formulate policy decisions through stakeholder coordination and public engagement. Three key pieces of analysis contributed to Chicago's adaptation strategy: an evaluation of Chicago's higher and lower greenhouse gas emissions scenarios; an assessment of Chicago's economic risk under both emissions scenarios; and a prioritization of potential impacts using a scoring system that included likelihood of occurrence and local consequences of occurrence.

Potential adaptation tactics were categorized according to their expected benefits and costs and led to the creation of working groups to develop action plans that will include primary actors, timelines, budgets, and performance measures that the City will monitor. While not essential for all cities, the impacts analysis was of high value to the adaptation strategy. However, a strategy for stakeholder engagement is crucial in ensuring that the implications of climate impacts are properly understood.

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In 2007, Mayor Richard M. Daley launched a comprehensive, multi-stakeholder planning process to tackle the very real impact of climate change on Chicago's environment and economy. One of the key features of the process was the decision to rely on rigorous analysis to formulate policy decisions. Research on climate impacts and costs of action and inaction had a profound impact on the Chicago Climate Action Plan that Mayor Daley launched in September 2008. The analysis helped Chicago decision makers to understand the scale and scope of the problem. It provided a means to engage stakeholders in discussion about useful responses, and built the case for aggressive action, provided a means to prioritize actions, as well as producing tools for engaging the public in climate action (City of Chicago, 2008).

The Chicago Climate Action Plan is Chicago's roadmap for reducing climate change impacts and adapting to the changes already occurring. This commentary focuses on how three key pieces of analysis informed Chicago's adaptation strategy.

First, University of Illinois and Texas Tech University scientists organized teams of researchers to analyze climate change impacts at the regional and city scales, applying international and national

climate change data to Chicago to evaluate both higher and lower greenhouse gas emissions scenarios (Hayhoe et al., 2010a; Wuebbles et al., 2010; and other papers in this special issue). Also see the reports done for the Chicago assessment at (Hayhoe et al., 2008) and (McGraw et al., 2008). This research helped decision makers to understand the benefits of early action to address climate change and provided a starting point for engagement with affected stakeholders about how to respond to climate change.

Second, international risk management firm Oliver Wyman, used the University of Illinois findings to complete an economic risk analysis comparing economic impacts on City infrastructure and services under both the higher and lower emissions scenarios. Oliver Wyman consultants interviewed numerous experts from 18 city departments to determine the extent to which each department's operations, assets, personnel and services would be physically and operationally affected by projected climate changes. The research revealed that almost every department would be impacted by climate change and how. It revealed that the cost under the high emissions scenario could be more than three times higher than the US\$700 million cost projected under the low emissions scenario. The Oliver Wyman research helped decision makers to see that reducing global greenhouse gas emissions would result in very large cost savings. Because of the engagement with departments, the Oliver Wyman research launched an on-going process of city departments considering climate change projections as part of decisions about infrastructure and programs (Wyman, 2008; Hayhoe et al., 2010b).

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Third, MWH, a global engineering firm, prioritized the potential environmental and economic impacts that Oliver Wyman and University of Illinois identified using a scoring system that included likelihood of occurrence and local consequences of occurrence. It compiled a list of best practice adaptation tactics to address the highest risks and prioritized the list based upon adaptation and mitigation benefits, costs, and catalytic potential. MWH's methodology is captured in the report, *Chicago Area Climate Change Quick Guide: Adapting to the Physical Impacts of Climate Change* (Parzen, 2008).

MWH scored about 70 research findings of climate risks based on likelihood of occurrence and local consequences of occurrence. For likelihood of occurrence, for example, MWH scored projections of temperature-based impacts and predictions that were supported by actual data as more likely to occur than more speculative storm impacts. Consequences were rated on overall severity of impact on health and safety and/or on economic impact. Using this process, MWH's analysis made it possible for Chicago decision makers to quickly focus on the highest risk climate change impacts.

MWH developed an inventory of potential Chicago adaptation tactics for reducing vulnerability to four key events: extreme heat, extreme precipitation, damage to infrastructure, and degradation of ecosystems. The inventory included tactics identified in the University of Illinois research and "best practice" adaptation measures planned in cities around the world that could be applicable to Chicago. For example, New Zealand offered a best practice for modifying planning processes to account for potential impacts of climate changes. New Zealand has issued guidelines for local authorities that include specific questions to be asked when drawing up individual plans, including whether the risk management analysis takes into account changes due to climate impacts and whether the plan includes a specific commitment to keep up-to-date with changing understanding of climate change implications.

MWH narrowed its initial list of 150 potential adaptation actions down to several dozen based upon expected benefits and costs, time horizon, and barriers to implementation. Benefit types included life safety, human health, prevention of significant infrastructure damage, preservation of ecosystem health, prevention of major economic disruption, maintenance of quality of life, uninterrupted city services, prevention of minor economic impact, maintenance of revenue, uninterrupted tourism, and reduced costs. For each benefit, MWH considered magnitude, timing, potential to lower carbon footprint, and catalytic potential.

MWH categorized as "Must Do/Early Action" high net benefit adaptation tactics designed to prevent impacts with a short-term time horizon and with few impediments to implementation. "Must Do"

Actions were high net benefit, but had potential impediments. It categorized as "Investigate Further" those tactics that addressed longer-term impacts, but had strong benefit to cost ratios. Finally, it categorized tactics that could have value in the long-term, but were high cost as tactics to "Watch." MWH identified numerous "No Regret" options that could deliver benefits greater than their costs, regardless of the extent of future climate change. For example, the City of Chicago adopted the "No-Regrets" tactic of updating its extreme weather operations plan using climate change projections.

The adaptation tactics for reducing vulnerability to extreme heat events that the City of Chicago adopted included examples from most of the categories. The City of Chicago began to focus existing tree planting by the Park District and Bureau of Forestry at locations where trees could reduce the urban heat island effect, which was a "Must Do" tactic. Another "Must Do" tactic the City pursued was to protect air quality in a higher temperature environment by initiating a process to amend the air ordinance. An "Investigate Further" tactic that the City has made part of its plan is to develop thermal environment maps. Many of the tactics to address both extreme heat and extreme precipitation align with the City of Chicago's long-standing commitment to green development, including green urban design, green infrastructure for storm water management, and greening for urban heat island reduction. This history has made it easier for climate change adaptation to become part of business as usual in Chicago.

MWH made recommendations not only for specific actions, but also for an on-going process to engage City decision makers in adaptation planning. Following this advice, the City of Chicago built the infrastructure it needs to continue to adapt as new climate research becomes available and to track its performance in both adaptation and mitigation. As shown in Fig. 1, the City of Chicago's cabinet-level Green Steering Committee of departments and sister agencies, led by the City's Chief Environmental Officer, formed five multi-departmental working groups to develop adaptation actions plans: extreme heat; extreme precipitation events; building, equipment and infrastructure vulnerabilities; ecosystem degradation; and leadership, planning and communication.

Currently, the City of Chicago has 39 specific adaptation tactics in various stages of implementation, including, in addition to those already mentioned: Reduce Urban Heat Island Effect through Strategic Planning; Implement Needs Assessment to Evaluate Drainage Infrastructure; Prepare Chicago Drainage Solutions Strategy; Commence Water Conservation Strategy; Develop Energy Resource Management Plan; Analyze Materials and Methods for Roadway and Rail Infrastructure; and Create and Implement Chicago Urban Forest Management Plan. Each adaptation work group is developing action plans



Fig. 1. Chicago's adaptation process organizational chart.

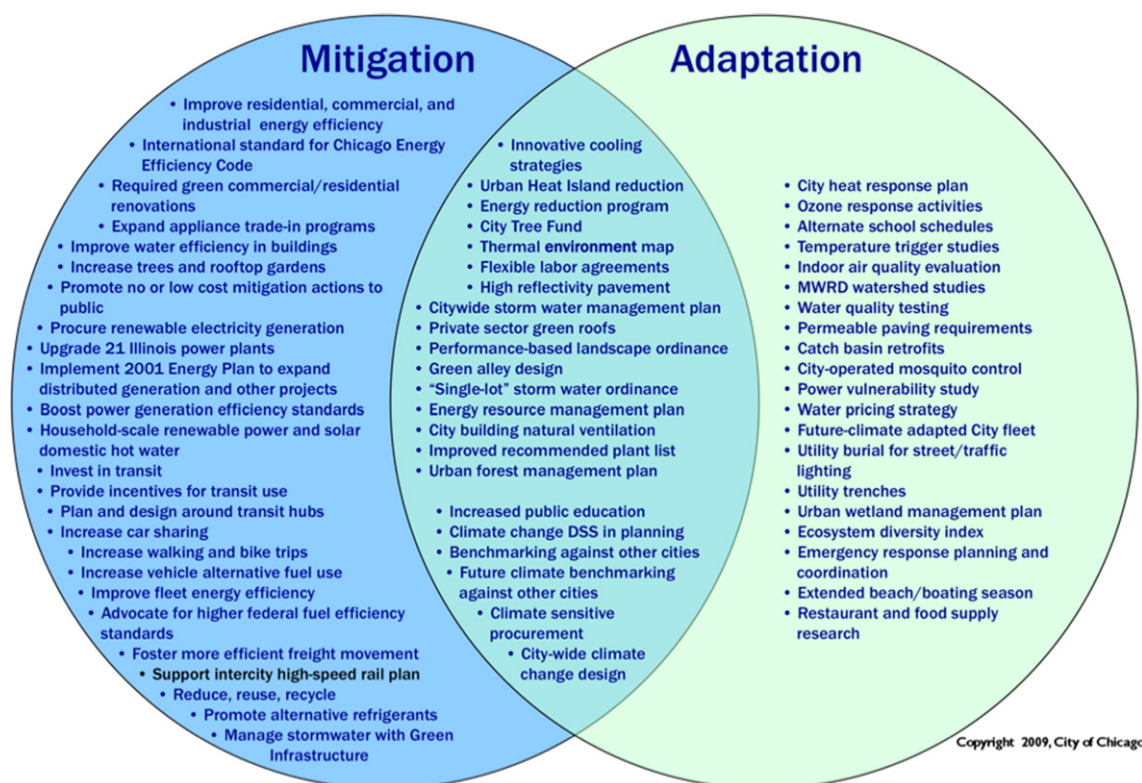


Fig. 2. Mitigation and adaptation nexus.

that include primary actors, timelines, budgets, and performance measures that the City will track.

The success of climate action planning is dependent upon tracking and reporting on performance over time. The City of Chicago's Continuous Improvement through Performance Measurement initiative for the Chicago Climate Action Plan includes periodic measurement of progress on each mitigation and adaptation tactic in the Plan. However, it also includes broad quality of life indicators that capture adaptive capacity. The City is in the process of finalizing what indicators it will track. Some examples of likely measures are days of good air quality, morbidity due to elevated surface temperature, decreased urban heat island impacts, increased permeable land area, percent of land covered by tree canopy, gallons of water usage per capita, and number of swim bans.

In sum, Chicago's climate impacts and adaptation analysis was of high value to decision makers during the development of the Chicago Climate Impact Plan, and continues to be so during implementation. Departments that gave input throughout the research process, continue to be engaged in a continuous improvement process. The analysis helped to catalyze Chicago's long-term process of mitigation and adaptation. It also helped the City to set priorities for action and hone in on win-wins that address both mitigation and adaptation, as shown in Fig. 2.

While it was useful to have impact analysis specific for Chicago, this is not essential for all cities. Cities increasingly can take advantage of existing research on climate impacts for their region. They can use

tools such as Oliver Wyman developed for Chicago to understand how city functions and infrastructure could be impacted. They will need a process such as MWH developed for Chicago for engaging stakeholders in addressing the implications of climate impacts.

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