

Energy Innovation and Success of Global Cities in a Carbon-Constrained World

By Robert Taylor

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Executive Summary

What role do global cities play in addressing climate change, and how can they succeed in a lower-carbon world? This report reviews the current national and international efforts being taken to address climate change and the impacts of these efforts on cities, as well as some examples of how cities are taking action through local policy. Staying competitive will require global cities to identify and implement policies that go beyond efforts to lower carbon emissions and minimize the economic impacts. In the new carbon-constrained world that is already emerging, cities should seek to position themselves to benefit from the changes to come. Two recommendations are presented:

- Benchmark and develop a plan of action.
 - Implement a defined process to compare cities to one another.
- Develop an active policy and regulatory position to encourage energy investment in cities.
 - Identify opportunities to improve and apply specific best practices that cities can use to establish themselves as centers of energy innovation and investment.

These two broad strategies would not require large funding outlays and would likely provide insulation from some of the coming effects of climate change for the city that chooses to engage in this process. Also, implementation may attract economic development.

The State of the World after Paris

Addressing climate change is the primary challenge of this century and potentially beyond. The results of climate change, which is driven by greenhouse gas emissions, including carbon dioxide, are already being seen and are expected to worsen in the form of more violent and unpredictable weather and rising sea levels. Scientists predict irreversible and catastrophic impacts to the Earth and all its inhabitants if the temperature increase exceeds 2 degrees Celsius. This level of increase is regularly used as a baseline to estimate the climate impacts of changes in carbon emissions (though many researchers prefer a goal of limiting the increase to 1.5 degrees Celsius to avoid the worst impacts).

If worldwide carbon emissions continue at their current rate, the Earth will likely cross the 2-degree threshold in 2036, only 20 years from now.¹ Significantly complicating matters is the fact that carbon emissions, usually from fossil fuels, are increasing in most of the developing world as those countries industrialize. So how does the world, with 196 countries with different interests, go about reducing carbon emissions? Calls from the developed world to hold emissions at their current levels and decrease from there don't go over well in India and China, where explosive growth in economies and carbon emissions are under way. Conversely, calls for the developed countries to make the majority of reductions in carbon emissions don't get very far either, as that introduces the perception of jobs leaving developed

countries for the developing world and increasing energy prices.

The truth is, meeting a worldwide goal of limiting global temperature increases to 1.5 or 2 degrees Celsius is going to require an immense effort by everyone. The United Nations Framework Convention on Climate Change (UNFCCC) has been meeting for 21 years in an effort to get a global agreement in place to limit climate emissions, with a disappointing track record to show for it over most of that period. A new approach was used by the parties to the UNFCCC for the 21st annual meeting in Paris in 2015: instead of trying to get all involved countries to sign on to a single plan, they asked each country to develop and submit its own plan to control carbon emissions.

The good news is that 196 countries submitted plans and agreed to a set of principles intended to control carbon emissions. The agreement includes a target to keep warming below 2 degrees Celsius and even recognizes the importance of the preferred 1.5-degree goal. The agreement calls for the countries to file updates on their progress and to meet again in five years to seek agreement on even more ambitious targets.

As promising as the Paris Agreement is, there are two major issues with it. First, there are no penalties for countries that don't meet their commitments. Second, even if all the countries meet their commitments, estimates show global warming will still exceed the 2-degree goal, perhaps by a wide margin.

Alongside the Paris Agreement came two announcements intended to build on the goals of the agreement. The first is that the United States and 18 other countries have agreed to double funds for clean energy research to a total of \$20 billion over five years. To build on that research, the Breakthrough Energy Coalition was launched with the intention to fund startups in a broad spectrum of industries, from agriculture to transportation to electricity storage. The coalition is backed by a range of high-profile philanthropists such as Microsoft's Bill Gates (who has committed \$2 billion), Facebook's Mark Zuckerberg, Virgin Group's Richard Branson, and Reliance Industries' Mukesh Ambani of India. The coalition seeks to leverage the increased research and development investment and provide funding for the next generation of energy breakthroughs. According to Gates, this would include technologies that range from improving carbon capture and storage to utilizing the energy of high-altitude jet stream winds.²

The Paris Agreement did not solve the world's climate issues, but it does indicate some hope that it can be built on it. Perhaps environmentalist Bill McKibben described the agreement best: "This didn't save the planet but it may have saved the chance of saving the planet."³

Recent events show the incongruity of efforts to address climate change. On the positive side, the Paris Agreement is a landmark achievement, and it represents the first worldwide consensus to limit carbon emissions. However, the US Supreme Court has ordered the US Environmental Protection Agency to halt enforcement of the Obama administration's Clean Power Plan until a lower court rules on a lawsuit against it. The plan is the centerpiece of the Obama administration's strategy to meet the US commitments of the Paris Agreement, and the Supreme Court ruling has complicated matters, possibly forcing the postponing of specific actions. Still, a consensus seems to be developing that the transition to lower carbon energy sources will continue to accelerate, driven by economics, state policies, and an expectation that the delay will be short lived.

How Does the World Move Forward from Here?

At a basic level, the primary barrier to efficiently transition to a low- or no-carbon future is economic. Certainly, actions are taken to meet specific governmental requirements (such as State Renewable Portfolio Standards) or voluntarily to purchase credit to offset carbon use, but for the general population, the price of carbon is zero.

There is surprisingly little debate among economists about the best way to put a price on carbon. Surveys estimate that 90 to 95 percent of economists support a carbon tax.⁴ Several specific proposals on how to implement a transparent, nonzero, and increasing price on carbon emissions have been made. A concise and convincing November 2015 proposal by 32 leading experts (including four Nobel Prize winners, three former US cabinet secretaries, and two former vice chairs of the Federal Reserve Board of Governors) details the benefits of a carbon tax and four principles to address climate change without discouraging economic growth:

- Carbon emissions should be taxed across fossil fuels in proportion to carbon content, with the tax imposed upstream in the distribution chain.
- Carbon taxes should start low so individuals and institutions have time to adjust but then rise substantially and briskly on a preset trajectory that

imparts stable expectations to investors, consumers, and governments.

- Some carbon tax revenue should be used to offset unfair burdens to lower-income households.
- Subsidies that reward extraction and use of carbon-intensive energy sources should be eliminated.⁵

What Is the Role of Global Cities?

With understanding of the challenges ahead, and assuming progress continues on recommended international policies to address carbon emissions and minimize the global impacts of climate change, how does this impact global cities?

Any efforts to address climate change will have to include a major focus on cities. Cities are the sources of up to 80 percent of worldwide carbon emissions, and demographic shifts indicate their populations will continue to grow. Additionally, the effects of climate change will have a large impact on cities since over 90 percent of them are coastal, putting them at direct risk of rising seas and more powerful storms. There doesn't seem to be much doubt that cities will see significant impacts from climate change and will have to play a leading role in any attempts to address it.⁶

What Can Cities Do?

One action cities could take to create an economically successful and low-carbon future would be to work toward becoming sustainable and decrease the contribution they make to climate change. This can include a range of activities such as deploying renewable energy, instituting energy-efficiency programs, and recycling. Many cities already have some or all of these programs in place, and they should be studied for best practices and most impact. Efforts such as these are critical to addressing the significant challenge ahead to balance the need to power the world while mitigating the effects on the climate.

These endeavors should, and often do, expand into proposals that are directly economically justified, such as deployment of energy efficiency and renewable energy, or projects to shift electrical usage in exchange for cash payments (known in wholesale markets as demand response). There are many documented cases of government agencies deploying outside capital to provide these energy savings in exchange for payments made from the contractually guaranteed energy savings.

Beyond these initiatives, global cities can and should do more. It's not enough to lower the carbon emissions of a

city and try to minimize its economic impacts. In the new carbon-constrained world that is emerging, cities should seek to position themselves to benefit from the changes to come. Becoming "100 Percent Renewable" looks good as a newspaper headline and is often justified by the purchase of renewable energy credits to offset the energy being used. These actions do not necessarily reduce energy consumption or reflect the energy actually used by the city. More difficult changes also must be made. These tough actions are investments that will pay off in added economic growth and drive innovation.

Recommendation 1: Benchmark and Develop a Plan of Action

Cities should seek to more fully understand the energy investment opportunities currently available to them, as well as what progress they have made to leverage these programs to their benefit and how they compare to peer cities. There already are models in use that would enable this kind of research, and the organizations currently performing this type of benchmarking work should be able to incorporate this analysis into their existing programs.

One model for this type of analysis is the European Innovation Partnership on Smart Cities and Communities. It focuses on speeding up the transformation of European cities into "smart cities," with an emphasis on:

- **Sustainable urban mobility:** alternative energies, public transport, efficient logistics, planning
- **Sustainable districts and built environment:** improving the energy efficiency of buildings and districts, increasing the share of renewable energy sources used and the livability of communities
- **Integrated infrastructures and processes across energy, information and communication technologies, and transport:** connecting infrastructure assets to improve the efficiency and sustainability of cities⁷

Another example that shows this can be accomplished across more varied cities is the California-China Urban Climate Collaborative. It was established to promote the exchange of best practices in urban sustainability and help advance recent agreements between US and Chinese officials that are meant to reduce greenhouse gas emissions. The collaborative aims to develop a "dynamic, new long-term exchange between cities in California and China seeking to reduce carbon and air pollution and advance the clean energy economy."⁸

One additional example is C40, a network of large cities around the globe that seeks to help members “collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change.”⁹

Thus, several groups and partnerships are focused on helping global cities do more in the fight against climate change, and that is an extremely positive sign. What is needed is a stronger focus on maximizing the potential benefits to cities from doing so.

The information gained in these benchmarking efforts would inform cities on where they lag behind their peers and would also identify specific opportunities that could be implemented. Potential opportunities could include:

- A partnership or joint goal between two cities (such as Chicago and Mumbai) to design and deploy a certain percentage of their city energy load as dispatchable, carbon-free generation (e.g., fuel cell or solar paired with batteries).
- An evaluation of innovative programs in other cities to evaluate implementation of a similar program while improving on any opportunities identified. For example, if it was determined that Paris experienced significant benefits from its Autolib’ electric-car-sharing program, Chicago should work specifically with Paris to implement a similar program.

Recommendation 2: Develop an Active Policy and Regulatory Position to Encourage Energy Investment in Cities

The regulatory framework for energy has historically been, and will likely remain, the dominion of nations and states, but the time has arrived for cities to develop a coherent vision of what they want that framework to be. The model currently used in most of the United States is that policymakers generally view cities as passive electricity consumers that must be served by the electric system, which is regulated by the state and federal governments. A plan for how to serve the passive electricity consumers is then developed either by states or by wholesale market administrators working with electric utilities, power generators, and other stakeholders. The perspective of cities is usually lacking in both of these scenarios.

Once a city has completed the benchmarking efforts described above, it should develop a set of principles to support energy investment so citizens paying for and using the power can benefit from it.

This process could be started by a small group of stakeholders led by the city to review the current regulatory framework and determine where mismatches in interest lie. Once a list of specific recommendations is formulated, the city should develop a detailed plan to advocate for and implement them with regulators and legislators as appropriate. Stakeholders should fully develop a set of priorities, but initial recommendations to evaluate include:

1. Review existing state or regional incentives for renewable energy and energy efficiency to ensure they are aligned with city interests. Specific recommendations to consider include:
 - Determine if existing goals ensure that a specific percentage of renewable energy targets are intended for installations likely to occur in the city. For solar photovoltaic (PV) systems, this would include an overall specific target for solar PV and a separate subgoal that a certain percentage should come from smaller systems more likely to be installed in urban areas.
 - Determine which technologies qualify for incentives and advocate for the inclusion of technologies that could excel in urban environments (such as fuel cells) but may not have been included in the programs.
2. Evaluate barriers to energy investment specific to urban areas. One factor complicating renewable energy deployment in urban areas, specifically for residential customers, is a lack of space for installation of renewable energy generators. Residents of global cities are more likely to live in denser areas. Residents of multifamily housing such as condominiums or apartments are often excluded from the benefits of direct renewable energy investment. One solution to this problem gaining significant traction is the idea of community ownership. Community solar projects appear to be getting the most attention in urban areas and in a variety of formats, including a group of citizens jointly buying into a solar project and sharing the benefits. The problem that should be addressed is that many states don’t recognize community ownership as an allowable structure under their incentive programs. Cities should review their own rules and regulations to ensure that these types of arrangements aren’t unnecessarily limited because of self-inflicted restrictions and take action to remove these barriers to energy investment.

The actions described thus far are intended to ensure a global city and its residents are taking advantage of the programs already available. Just doing that would be a great start in ensuring citizens benefit from the investments being made. The following steps will enable cities to identify opportunities to outperform their peers and position themselves for success in a carbon-constrained world.

3. Develop an active policy and regulatory position to enhance those initial investments and innovative new tools identified in recommendations 1 and 2 into even greater benefits. For cities located in areas served by organized wholesale energy markets, even greater potential benefits are likely to be available. In these instances, cities can attempt to reduce energy consumption and shift electric usage to different times of the day. Agreeing to forego electrical use when electrical usage is near peak loads can result in direct payments to the customer, which can be in addition to the savings for the electricity not used. In wholesale markets, this is referred to as demand response. Cities that can take advantage of these programs should. Doing so in a public way could build an ecosystem within the city to bring increasing benefits to the city from direct payments to growing companies finding new ways to leverage these opportunities. Cities that don't have these markets available should encourage policymakers to develop them. Cities should review the positive attributes of these market programs in states with a more state-regulated electricity framework.
4. Collaborate with regional universities to leverage research, development, and demonstration of energy projects to establish the city as a hub for innovation.
5. Work with stakeholders, regulators, and utilities to develop recommendations to improve the electric grid to support lower-carbon goals. This could include improvements to allow greater amounts of intermittent renewable generation, deployment of localized microgrids, or increased support for electric-vehicle charging.

Implementing these recommendations could position the global city as an attractive location for businesses. These policies would draw companies, like solar PV system installers and project developers, as well as leverage the efforts of regional universities and research laboratories to make the city a hub for energy innovation and deployment.

Future research on this issue should include a further validation of the impacts of the policies recommended here as well as consideration of other potential improvements.

Conclusion

Despite uncertainty over the timelines in the US Clean Power Plan, the progress toward a low- or no-carbon economy is expected to continue. Global cities are making the decisions that will set the stage for how resilient they are to the coming changes. While many are taking actions to reduce their carbon emissions, they should take two additional steps to position themselves to benefit from this transition: benchmark and develop a plan of action and develop an active policy and regulatory position. By taking the right actions now, cities can establish themselves as centers of energy innovation and investment. This would not require large funding outlays, would likely provide some insulating benefits to the coming effects of climate change, and might attract economic development.

The Emerging Leaders Program

The Emerging Leaders (ELs) Program prepares the next generation of leaders in Chicago's public, private, and nonprofit sectors to be thoughtful, internationally savvy individuals by deepening their understanding of global affairs and policy. During thought-provoking discussions, dinners, and other events, ELs gain a broader world view, hone their foreign policy skills, and examine key global issues. Emerging Leaders become part of a network of globally fluent leaders who will continue to raise the bar for Chicago as a leading global city.

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About the Author

Robert Taylor
Principal Transmission Strategy Specialist
Exelon Corporation

Robert leads initiatives and advises senior Exelon leadership on broad energy issues including electricity generation, efficiency, finance, markets, transmission, regulatory affairs, strategy and policy development. Prior to joining Exelon, he was an Energy Policy and Programs Manager with the Commonwealth of Pennsylvania and also has a background in Radiation Health Physics. Robert has a BS in Nuclear Engineering Technology from Thomas Edison State College, and a Master of Public Administration from the University of Missouri's Truman School of Public Affairs.

Endnotes

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332 South Michigan
Suite 1100
Chicago, Illinois 60604-4416
www.thechicagocouncil.org