Urban Energy Program

Urban Energy Systems

CHP in NYC: A Viability Assessment

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CENTER FOR ENERGY, MARINE TRANSPORTATION AND PUBLIC POLICY

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CHP in NYC: A Viability Assessment

This report represents the culmination of work begun by a team of graduate students participating in the Urban Energy Workshop sponsored by the *Center for Energy, Marine Transportation and Public Policy* at Columbia University's School of International and Public Affairs. As part of this workshop, the team conducts research on a topic of interest to stakeholders interested in urban-scale energy issues.

The topic for this report was selected in consultation with the Energy Department at the New York City Economic Development Corporation (EDC), the unit that serves at the principal energy policy advisor to Mayor Michael Bloomberg. Although this report was prepared for the benefit of EDC, it is not an official agency publication and as a result does not necessarily represent the views of the City of New York.

In carrying out this research, the team received assistance from Craig Wilson, Senior Project Manager at EDC, along with a lengthy list of industry experts and local stakeholders too numerous to name here. We gratefully acknowledge the contribution they made to the drafting of this report.

Despite the tremendous amount of assistance that we received, any omissions or errors in fact are entirely the responsibility of the authors.

Workshop Advisor
Dr. Stephen Hammer
Director, Urban Energy Program
Center for Energy, Marine Transportation and Public Policy
School of International and Public Affairs
Columbia University
sh2185@columbia.edu

Principal Editors
Stephen Hammer
Jeanene Mitchell

Research and writing support was provided by the following Project Team:

John Atkinson
Kate Bashford
Peter Falcier
Jacob Sung Shik Kim
Anna Kleppert
Natalia Lesnic
Jeanene Mitchell
James Munsell
Caroline Rozeira de Mariz
Kyla Westphal

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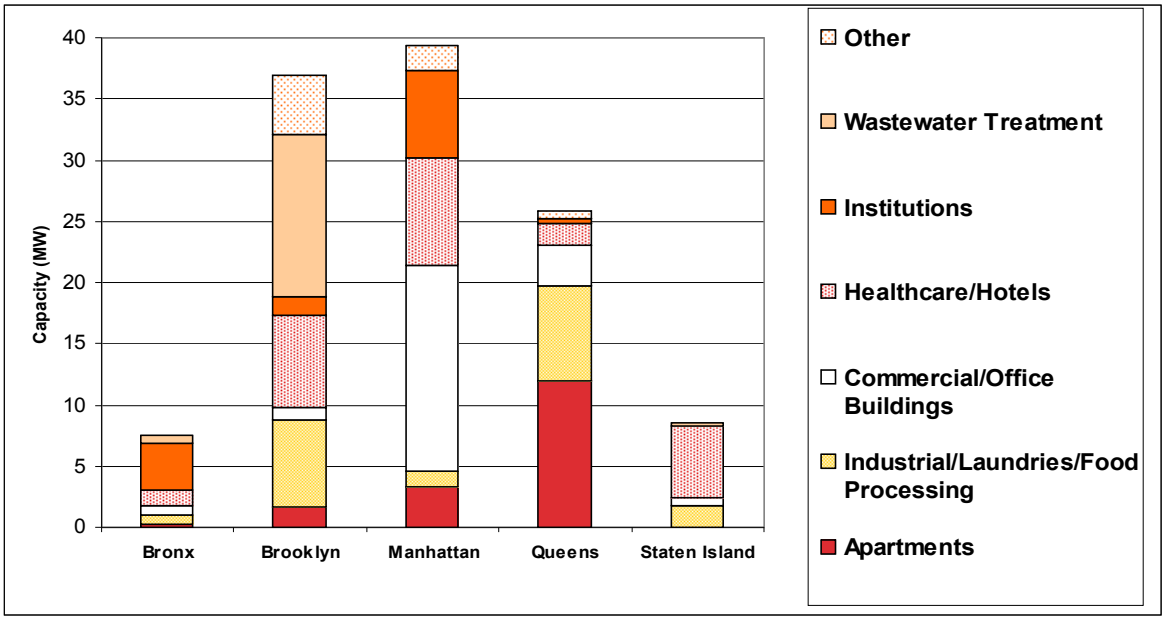
CENTER FOR ENERGY, MARINE TRANSPORTATION AND PUBLIC POLICY

CHP in NYC: A Viability Assessment
Executive Summary

By several different accounts, New York City faces an imminent electricity supply shortfall due to steady demand growth, the anticipated retirement of existing in-city power generation capacity, and difficulty siting and financing large new in-city power plants. *PlaNYC*, the long-term growth and sustainability plan released by New York City Mayor Michael Bloomberg in April 2007, details a variety of approaches the City can pursue to reduce the size of this anticipated supply gap. This analysis, prepared for the benefit of the Energy Department at the New York City Economic Development Corporation (EDC), examines the local viability of one of the technologies cited in *PlaNYC* – the use of small-scale (<10 MW) cogeneration technology, also known as combined heat and power (CHP) systems.

The name refers to the fact that CHP technology simultaneously generates heat and electricity at or near the point where the energy will be consumed. Because of their design, CHP systems are on average more than twice as efficient as conventional, large-scale central station power plants. As a result, CHP technology is potentially a valuable tool in *PlaNYC*'s efforts to reduce local greenhouse gas emissions.

Figure 1. Total Installed Capacity of Small-Scale CHP Systems in New York City (by Application and Borough)



There are a range of CHP technologies currently deployed around New York City in different settings, exploiting both older and cutting-edge system designs. The vast majority of systems are powered by reciprocating engines, a familiar technology available in a wide range of system sizes. Microturbines represent a newer technology that is quickly gaining in popularity, likely attributable to its position as the only CHP technology currently eligible for federal tax credits. Microturbines tend to be smaller in their power generation potential, contributing to a decades-long trend of decreasing average CHP system size around New York City.

Figure 2. New York City CHP Installations and Capacities (1974-2006)

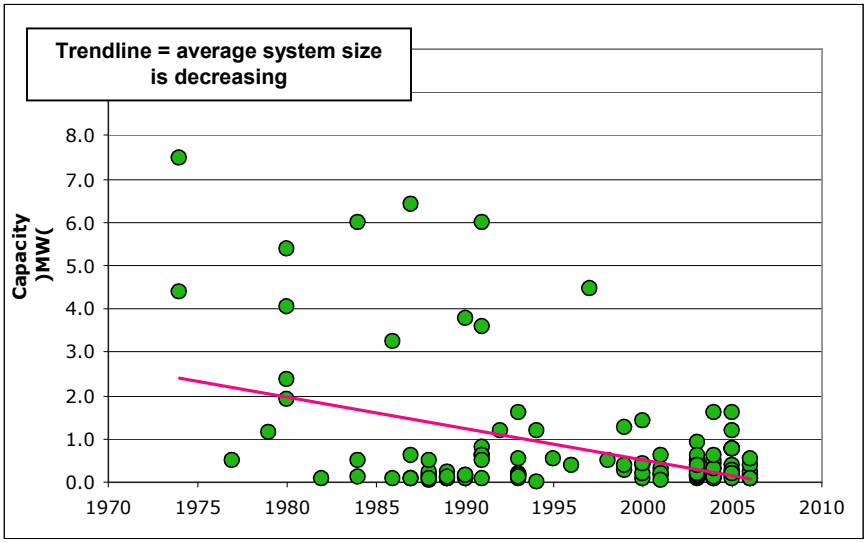
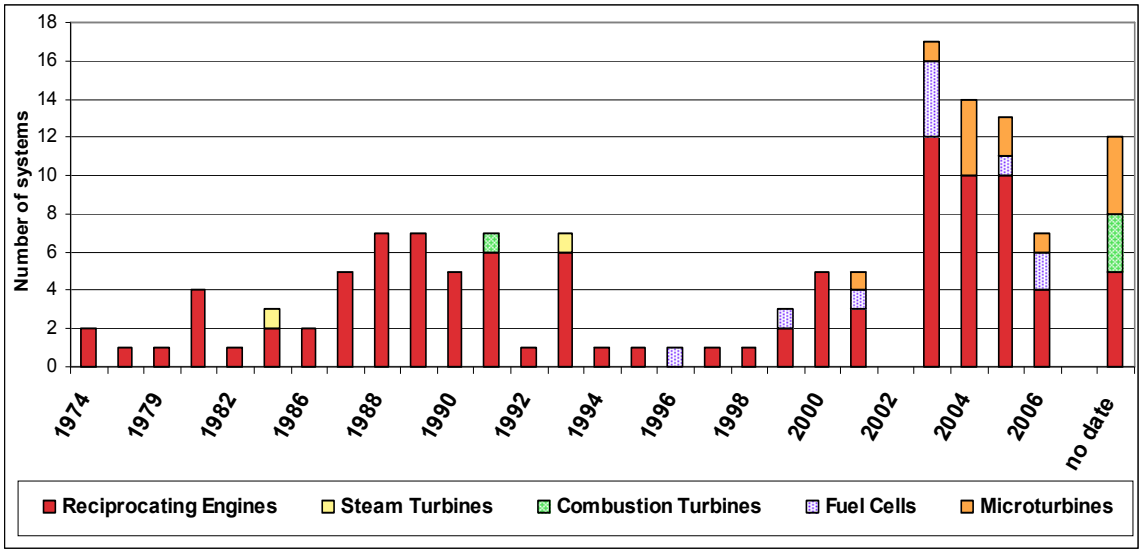


Figure 3. Number of CHP Systems Installed in New York City (by Technology Type) (1974-2006)



A 2002 study by the New York State Energy Research and Development Authority (NYSERDA) forecast significant potential for the deployment of CHP technologies around New York City, totaling nearly 3,200 MW of capacity across various commercial, residential, and industrial sectors. Current deployment lags far below that level, however. Of the 135 local small-scale CHP systems currently installed around the city, we estimate their aggregate capacity at 118 MW, or just 1% of overall local power generation capacity.

There are many factors that influence the current deployment situation, both positively and negatively. Most relevant to the local story are key obstacles that we believe make attainment of *PlaNYC's* deployment target of 800 MW of CHP by 2030 rather challenging. These include:

- **The mechanics of connecting to the Con Edison grid – CHP technology's 'Achilles Heel'**

When a CHP system is linked to the local electric grid, it is said to be 'interconnected' to the grid. When CHP systems operate completely independently of the grid, they are considered to be in 'grid-isolated' or in 'island' mode. Virtually all systems deployed in New York City are interconnected, with the building using the CHP system to generate some portion of its electricity load on-site while deriving the rest of its power from the Con Edison electric grid. This configuration occurs primarily because the price of local real estate makes it too costly to build a CHP system large enough to meet all of a building's energy needs.

The fact that CHP systems must interconnect to the Con Ed grid is potentially problematic because they represent new power sources at locations where the grid was not originally designed to accept them. As a result, the CHP system could send its power out of the building and back into the grid, energizing lines thought to be dead, posing a safety risk to Con Edison repair crews and potentially damaging transformers and other equipment on the line. Con Edison engages in a detailed engineering analysis of each interconnection proposal to determine what – if any – impact it might have at that location on their network. State regulators grant Con Edison the authority to impose technology requirements on the project developer as a pre-condition for approval of the interconnection, generally with all costs borne by the party proposing the installation. This situation is monitored by state regulators to ensure the fairness of these requirements. Some of the stipulations are costly, however, potentially destroying the otherwise favorable economics of a project. In the future, less complex technological solutions such as fault current limiters and other types of power electronics may help overcome this problem, but some of these technologies are still at the early stages of development, and their local viability remains relatively unproven. We believe EDC and NYSERDA should examine the option of providing some mechanism for offsetting the costs associated with these devices as one way of encouraging CHP deployment. Microgrids, which are small independent power distribution systems that are currently being pursued in London and other cities, may also represent an innovative approach to circumventing some or all of the technological problems associated with interconnections.

- **A complex policy environment and approval process**

Federal and state policies have been quite helpful in supporting local CHP deployment, significantly improving the economics of project installations by providing valuable tax credits and direct project subsidies. New York City's own policymaking efforts are increasingly CHP-friendly, although Fire Department (FDNY) concerns over the high pressure gas lines required for microturbine projects have clearly had a chilling effect on the use of this technology around the city. Though a special task force convened by City Hall to address this issue has reportedly made progress in resolving FDNY concerns, final rules have yet to be formally adopted, so it is uncertain what proportion of these projects will eventually obtain approval. Once the task force has finished its work, local stakeholders would benefit from learning how the microturbine issue was ultimately resolved.

Con Edison policies and procedures for interconnections are a more vexing matter, raising issues that go beyond the physical considerations of linking to the grid. In public documents Con Edison sounds broadly supportive of CHP technology, but many complaints have been levied by project developers about the opaque application process they must follow to win Con Edison's approval to interconnect CHP systems. In many ways, New York City is no different than other cities in this regard, as research has uncovered similar complaints about the transparency and predictability of the interconnection application and review process involving other utilities. In *PlaNYC,* the City proposes steps that should address some of these concerns locally. Worth noting, however, is the fact that state regulators monitoring this issue report they field few customer complaints about interconnection issues, and that problems often appear to result from communication failures by both parties. New York State Public Service Commission staff also

acknowledge the complex nature of Con Edison's network grid, saying that part of the application review problem may be that it's simply harder to interconnect systems in New York City than in other cities.

For that reason, it is unclear how much of the difficulty faced by local projects is a learning curve problem rather than a fundamental shortcoming in the interconnection review process. As Con Edison engineers and project developers gain experience working with these systems, the process may become more predictable. Depending on how the CHP market matures – either tending towards a large number of small projects that are easier to interconnect, or a lesser number of big projects that are more difficult to interconnect – there may also be increased pressure for reforming the interconnection process. It behooves Con Edison to monitor market trends and ensure that staffing levels are sufficient to keep interconnection projects moving apace.

- **Project Economics – Multiple Challenges to Keeping Project Budgets on Track**

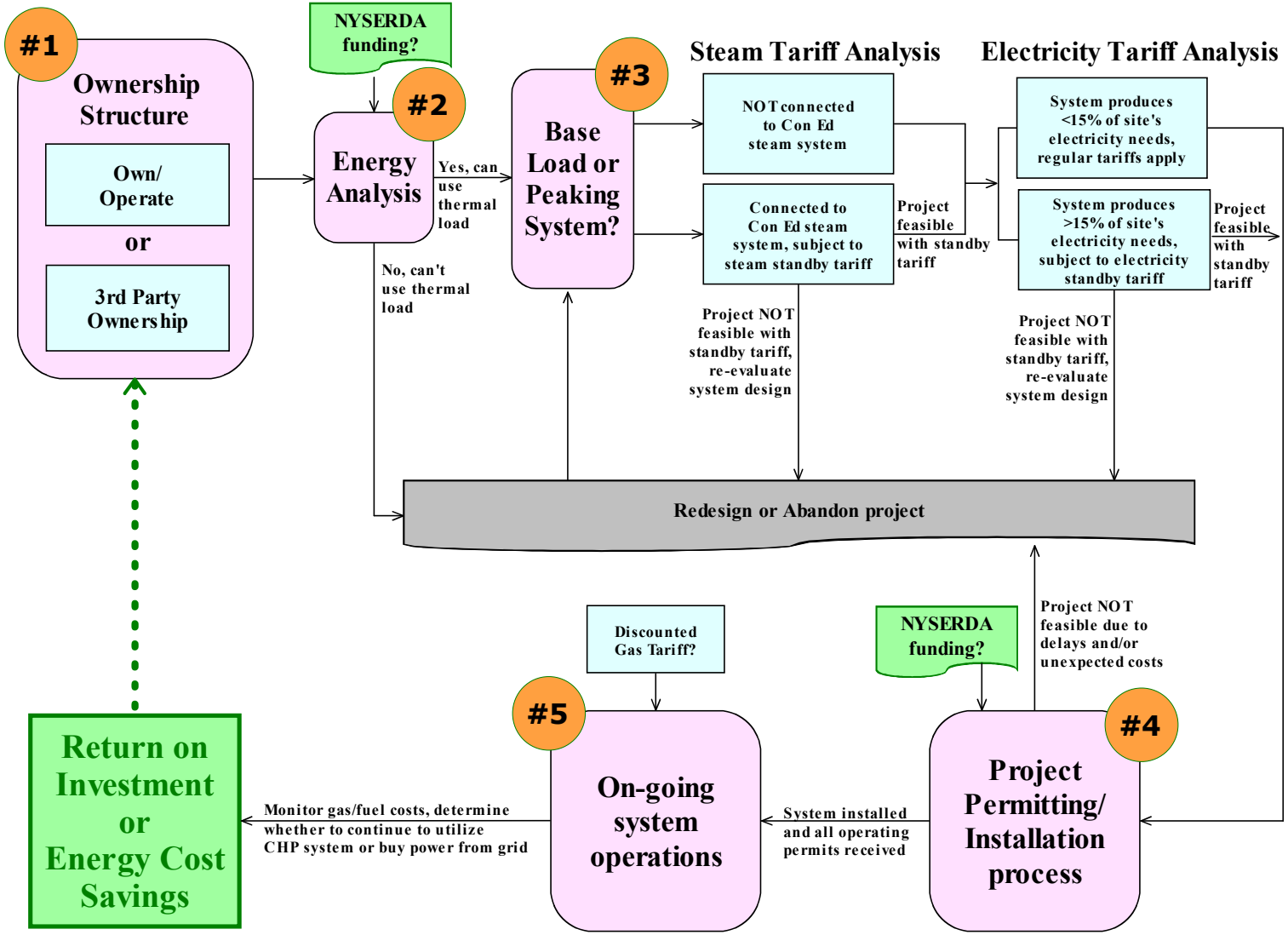
Although facility owners may pursue CHP for several reasons – such as an interest in climate protection or enhanced on-site energy security – at the end of the day, most projects will only be realized if they deliver energy services at a cost equal to or lower than existing grid-based sources. In diagramming the basic decision schema faced by CHP project developers, we have identified five key factors that heavily influence whether projects keep moving forward or run off the rails. [See Figure 4] These include the basic system ownership model, whether there is adequate demand for a system's thermal output, the interaction between utility tariffs and system design, project development costs, and on-going operating costs.

The ownership model is a key starting point, as new market mechanisms known as third-party ownership now put CHP system deployment within the reach of those who previously would have had difficulty affording these systems. System design is another important issue, and must take into account both the thermal and electric demands of the building, in order to ensure the full utilization of the CHP system's heat output. Local tariff structures will further influence the size of the system deployed. Developers must carefully assess whether their CHP system will bump them into an alternative, more expensive tariff class for the balance of their energy needs, potentially destroying the original economic justification for the project.

It is difficult to generalize the development costs for local CHP projects, due to their site-specific nature. The various issues associated with interconnections are often of critical importance in this regard, as Con Edison's technical review may result in additional engineering studies and new componentry not included in the original project budgets. Permitting process delays can also cause projects to lose favorable financing terms. These circumstances collectively add up to a situation where prospective CHP system owners and developers must tread warily when estimating their project budgets, particularly on larger installations, where the perceived risk to the Con Ed system is generally greater. Once a system is operational, it is important to closely monitor fuel costs, as high natural gas prices can at times make CHP more costly than purchasing power from the grid.

In other words, balancing the various economic decisions and uncertainties involved with a CHP project is quite a challenge. Local officials are in a position to help alleviate this situation by providing additional funding for CHP viability assessment studies and focusing advocacy efforts on CHP-friendly tariff structures at the state level.

Figure 4. CHP Economic Decision Schema: Key Factors Affecting the Economic Viability of CHP Projects
Source: Based on original research by Jeanene Mitchell and Stephen Hammer



Conclusion

Combined heat and power technologies can play a significant role in helping New York City address its impending in-city electricity supply shortfall in a more sustainable manner. The growing number of small-scale installations around the city – 40% of which have been deployed in the past five years alone – testify to the value of CHP's greater efficiency and money-saving potential. With the Regional Greenhouse Gas Initiative coming into effect in 2009, bringing with it the prospect of higher electricity prices for grid-based power, CHP may become an even more attractive option for meeting New York City's electric and thermal needs.

Despite the benefits of CHP, there are many opportunities for projects to become sidetracked locally. As this report repeatedly notes, interconnection is a major hurdle, and until it is adequately resolved – through technological solutions, learning-by-doing, or changes in basic market structures, ***PlaNYC*'s goal of 800 MW of CHP by 2030 must be seen as a rather optimistic target**. We advocate a two-track approach, in which the City works with state officials and key market stakeholders to improve both the short and long-term outlook for CHP technologies.

As a first step, we believe that a local 'CHP Partnership' should be established to provide overarching direction and support to any CHP market development effort, operating under the auspices of the City's Economic Development Corporation. This public-private partnership, consisting of local and state government officials, utility representatives, and other key energy sector and environmental/community stakeholders, could harness the knowledge and financial resources necessary to tackle the most pressing issues impeding CHP deployment.

As part of its short-term strategy, the New York City CHP Partnership should focus on evaluating the interconnection guidelines and process currently in place. Policymakers and Con Edison would both benefit from an independent assessment of such issues, as it should clarify the extent to which interconnection difficulties must remain an unavoidable fact of life for local CHP projects. The review should also examine whether Con Edison's fundamental approach towards distributed generation is excessively cautious, or whether it is entirely appropriate given the need to maintain high levels of system reliability.

As a longer term strategy, we believe the Economic Development Corporation and the CHP Partnership should conduct research into new market structures and regulatory systems that more systematically incentivize CHP interconnections with the local grid. The *PlaNYC* report has already announced the Mayor's interest in this subject, and much work must be done to explore how to change the local regulatory schema so it more explicitly rewards Con Edison for facilitating CHP and other distributed generation deployment. Rules promoting microgrid development could also help build demand for CHP technology, as these units would serve as the heart of microgrid energy systems.

As an ever-growing center of global commerce, industry and culture, New York City's burgeoning energy demand shows no sign of abating. While there is a clear role for CHP to play in filling the supply gap, CHP's potential will only be realized to the extent that a pro-CHP policy environment can be implemented within New York City.

Summary of Recommendations

***Recommendation #1**: The City of New York should work with Con Edison to examine ways to accelerate the pace of network protector device upgrades on the network. This includes fostering collaboration between Con Edison and various City agencies to ensure that Con Edison receives all necessary permit approvals to carry out this work in a timely manner.*

***Recommendation #2**: The City of New York should work with Con Edison and the NYS Public Service Commission to develop more refined maps detailing the extent of the fault current problem within individual network grids. These maps should indicate the different technological options for fault current mitigation available within specific areas, including inverted generation and fault current limiters. This information should then be used in targeted education and outreach efforts promoting CHP deployment among building owners around New York City.*

***Recommendation #3**: The New York City Economic Development Corporation should work with NYSERDA and the NYS Public Service Commission to examine whether investments in fault current limiters or power electronics by CHP system developers should be entitled to some type of financial relief from the utility or other entity to help offset the additional cost of these devices.*

***Recommendation #4**: The City of New York should work with Con Edison and the NYS Public Service Commission to examine how the 10/20 MW limits for interconnected DG might change if these limits were instead calculated as a percentage of peak demand, as is the practice commonly followed by other utilities. The results of this study should be used to select the method of calculating interconnected DG limits with the greatest potential for increasing levels of CHP deployment in New York City.*

***Recommendation #5**: The City of New York should work with the New York City Congressional delegation to advocate for an extension and possible expansion of the federal CHP business tax credit program.*

***Recommendation #6**: The NYC Economic Development Corporation and Department of Buildings should establish a mechanism to more systematically educate local developers of large new building projects about NYSERDA CHP-funding opportunities. EDC should also work with NYSERDA to develop funding programs specifically designed to support education and outreach programs targeting the local industrial sector and real estate developers and managers in New York City.*

***Recommendation #7**: The New York City Economic Development Corporation should work with NYSERDA and the New York State Department of Environmental Conservation to examine current emissions regulations to determine how the review process can more accurately account for the emissions benefits delivered by CHP.*

***Recommendation #8**: Once the Cogeneration Task Force has completed its work in resolving FDNY safety concerns with microturbines, the NYC Economic Development Corporation should collaborate with the NYC Department of Buildings to host a workshop educating building owners/managers and other key stakeholders on how the issue was resolved. This information should also be posted on the EDC website.*

***Recommendation #9**: The NYC Economic Development Corporation should seek the collaboration of a range of key local stakeholders in developing the specifications for an on-line portal tracking the status of CHP interconnection applications at Con Edison.*

***Recommendation #10**: The NYC Economic Development Corporation should fund the development of a "DG Ombudsman" position responsible for helping to resolve CHP system installation problems in New York City.*

***Recommendation #11:** The NYC Economic Development Corporation should meet with Con Edison to discuss their interconnection review staffing plans to ensure the utility is taking all steps necessary to support a potentially dramatic increase in interconnection applications.*

***Recommendation #12**: If the City receives approval to establish its own independent financing mechanism for local energy projects, the New York City Economic Development Corporation should allocate a portion of the funds to supplement existing NYSERDA monies available for CHP viability assessment studies.*

***Recommendation #13**: The NYC Economic Development Corporation should work with the Public Service Commission to examine the extent to which standby tariffs penalize CHP operations in New York City. As part of this analysis the City and State can examine ways to enhance the use of natural gas tariffs as an incentive for expanding CHP system use around the city.*