Removing Barriers to the Development of Clean Distributed Generation and Combined Heat and Power

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ABSTRACT

Distributed generation (DG) can be defined as small, modular electricity generators sited close to the customer load that can enable utilities to defer or eliminate costly investments in transmission and distribution (T&D) system upgrades, and provide customers with better quality, more reliable energy supplies and a cleaner environment. *Clean* distributed generation is that subset providing demonstrable environmental benefits when compared against traditional power generation and delivery technologies. Combined heat and power (CHP) is the simultaneous production of electrical or mechanical power and thermal energy from a single process. CHP is an application of distributed generation.

Well designed CHP projects are the essence of energy efficiency – that is, they use energy in a highly efficient manner. CHP may also provide significant environmental benefits. All else equal, less fuel consumed to meet a site's requirements for cooling, heating and power implies that emissions of air pollutants and greenhouse gases are less than they would otherwise be. The market for CHP applications is potentially sizeable. Recent research sponsored by the New York State Energy Research and Development Authority finds that with a favorable environment, CHP could provide nearly 2200 MW's of new power at locations in New York State within a decade. There is great promise for the development of clean DG/CHP options. However there remain many hurdles, including local siting, permitting and code issues that are likely to slow their installation and deployment.

This paper reports on the results of a project to identify and help minimize these barriers to clean distributed generation development in New York. In particular, the paper will discuss the development of a guidebook addressing local codes, siting and permitting issues typically encountered when installing smaller-scale CHP systems. The objective of the guidebook is to step prospective project developers, owners, and planning/code officials through all applicable regulations governing CHP/ Clean DG project development. Siting and permitting issues represent a subset of a much larger group of hurdles affecting the development of more robust markets for these technologies. Therefore, this paper also reports on various other policy instruments designed to encourage clean DG project development.

Introduction

The Department of Energy defines distributed generation (DG) as small, modular electricity generators sited close to the customer load that can enable utilities to defer or eliminate costly investments in transmission and distribution (T&D) system upgrades, and provide customers with better quality, more reliable energy supplies and a cleaner

environment[1]. *Clean* distributed generation is that subset providing demonstrable environmental benefits when compared against traditional power generation and delivery technologies. Combined heat and power (CHP) is the simultaneous production of electrical or mechanical power and thermal energy from a single process. CHP is an application of distributed generation.

CHP is already an important generating resource in New York with approximately 5,000 MW of capacity installed at 210 sites. The technical potential for new CHP is an estimation of the remaining market size constrained only by technological limits—the ability of CHP technologies to fit existing customer energy needs. A recent report (NYSERDA 2002) evaluated the technical potential for new CHP in commercial, institutional, and industrial sites by screening a comprehensive facility database according to size and application criteria that would allow for operation of a CHP system which employs both a high-load factor and high-thermal utilization.

The report identified nearly 8,500 MW of technical potential for new CHP in New York at 26,000 sites. While existing CHP in New York is concentrated in very large plants, only 16 sites remain that could support a plant size greater than 20 MW for internal power consumption. Close to 74% of remaining capacity is below 5 MW and is primarily at commercial and institutional facilities.

Market penetration of CHP will depend on the degree of economic advantage for CHP compared to separately purchased fuel and power, the prevailing size of the CHP market, the speed with which the current market can ramp-up in the development of new projects, and the sites remaining with economic potential. In the NYSERDA market potential study, these factors were combined into a simple market-estimating model that show in the *Base Case* scenario an estimated 764 MW of CHP will be installed by the year 2012, whereas in the *Accelerated Case* scenario market penetration reaches nearly 2,200 MW during the same timeframe.

Penetration of CHP into the commercial/institutional and light industrial markets has been minimal to-date. This is likely due to a combination of factors, including: deficiencies in small CHP technologies and systems; lack of an adequate sales and service infrastructure for small systems; low familiarity of users and building owners of CHP systems and benefits; and, a number of critical market and regulatory hurdles. These hurdles encompass a variety of concerns that typically face new entrants offering competing products and services in markets with well-established incumbents. Implementation of CHP creates a complicated interaction between the user and the local power distribution utility. The CHP system must meet interconnection regulations and requirements that are, in some cases, not well defined and costly to meet. The tariffs for backup and supplementary power services are higher in New York than in other large states where CHP has made an impact – such as California, Texas, and Illinois. Securing the necessary permits for a CHP system can be an expensive and time-consuming process. Local building codes often don't adequately address the needs of CHP systems, creating delays, expense, and uncertainty for project developers.

[1] U.S. Department of Energy, Atlanta Regional Office – Distributed Energy Resources. Source: http://www.eren.doe.gov/aro/der.html

Hurdles to the Development of CHP/DG Markets

While CHP represents a significant energy resource for New York, on-site generation, particularly small on-site generation, has historically faced severe market and regulatory hurdles. These may include utility practices and electricity rate designs that discourage on-site generation, lengthy and costly environmental permitting and siting processes, uneven tax treatment of on-site generation assets, and high customer hurdle rates for energy related investments. These obstacles can stand in the way of CHP and clean distributed generation competing effectively in markets for electric power services. These issues include:

- *Utility Interconnection Regulations and Requirements* – The optimal economic use of CHP for most customers requires integration with the utility grid for back-up, supplemental power needs, and, in selected cases, for marketing or wheeling generated power. Therefore, the key to the ultimate market success of small on-site generation is the ability to safely, reliably and economically interconnect with the existing utility grid system. However, grid interconnection requirements for self-generators, as they exist today, at times pose a hurdle to more widespread economic deployment of CHP. These requirements add cost, complexity, and uncertainty to the process of developing CHP projects. New York State has been a leader in efforts to attempt to streamline this process.
- *Air Permitting Issues* - New CHP projects in New York must negotiate a course through a system of environmental regulations. Like interconnection, air permitting issues may add cost, complexity, and uncertainty to the CHP development process. In addition, the potential benefits of higher efficiency and lower overall emissions that CHP offers may be blocked by sub-optimal regulations that control emissions based on fuel input rather than useful work and that focus on incremental emissions at a site rather than on net incremental emissions overall. New York is among a handful of States that is in the process of examining a new approach to regulating smaller-sized electric generating equipment.
- *Local Siting Issues* – CHP systems must meet applicable building codes and standards. These codes often do not adequately address CHP systems and emerging technologies. Enforcement of codes and standards is hampered by a lack of familiarity and understanding with on-site generation systems.
- *Tariff Issues* – Electric utility customers that self generate must contract with their utility service provider for standby, maintenance and supplementary power. They also should have the opportunity to sell or wheel power that is not needed on-site. Utility charges for this service should reflect the true costs of serving generating customers so that onsite generators are not paying more than their fair share. Utilities that consider on-site generation a market threat are often able to discourage on-site generation by either erecting economic hurdles through high standby charges or expensive interconnect requirements, or by offering economic incentives to forego installation through deferral rates. Unless carefully guarded against, utilities may assess these charges in a discriminatory manner imposing an effective barrier against CHP projects.

- *Economic and Financing Issues* – CHP projects require an up-front investment to generate a future stream of savings for the user. CHP investment, like any type of investment, carries risks that future savings will not materialize. There is a risk that unforeseen changes in future fuel and electric prices will not provide the required financial margin or that the CHP technology itself will not perform as well as projected or cost more to maintain and operate. Related to project risk, but also separate, is the availability of financing to implement CHP projects. Commercial, industrial, and institutional entities that operate facilities that could utilize CHP may either lack capital for investment or be unwilling to commit capital for energy projects that meet reasonable targets for return on investment.
- *Regulatory and Policy Initiatives* – Some of these issues can be resolved by legislative and regulatory initiatives. Indeed, there has been positive movement in New York in several critical areas. New York State has been a national leader in the development and implementation of standardized interconnection requirements. With respect to standby tariffs, in October 2001, the Public Service Commission adopted generic principles to guide the establishment of rates, terms and conditions for electric standby service. The Department of Environmental Conservation has announced the initiation of a rulemaking process permitting small electric generating units. This process is scheduled to result in a draft rule issued in 2003.

Numerous regulatory proceedings and other actions are underway in New York State to address interconnection and economic issues. It is recognized that while critical progress is needed on these issues, local siting and permitting issues can become another hurdle and source of costly delay to the development of clean DG projects.

The New York Clean DG Siting, Permitting and Codes Guidebook

NYSERDA recognized the need to assist project developers and other stakeholders, including local codes and permitting officials, in understanding the various issues and regulations surrounding small DG projects. In 2001, NYSERDA, with funding provided by US DOE through Oak Ridge National Laboratory, contracted with the Pace University Energy Project to prepare a "Guidebook" to address codes, siting, and permitting issues related to the installation of CHP and clean DG projects.

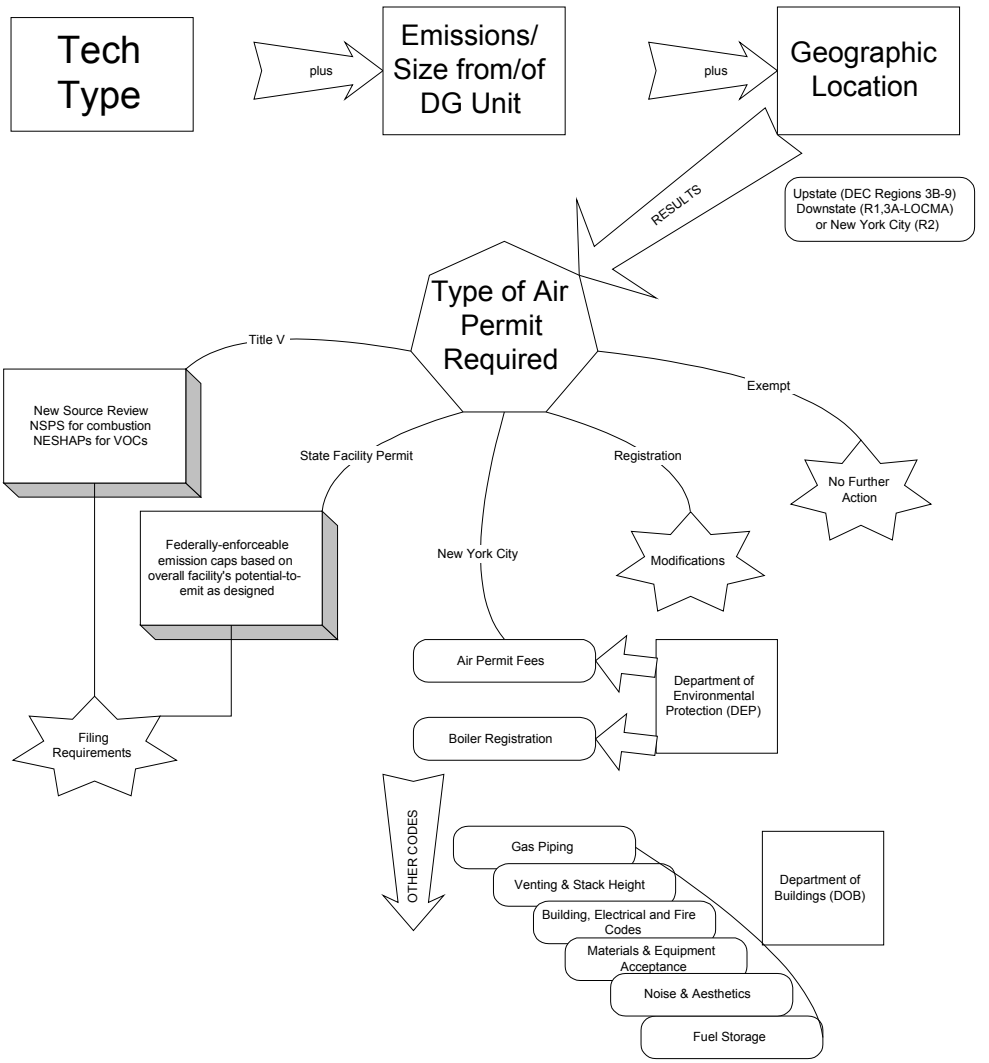
The guidebook has been developed as an interactive, drill-down capable, HTML linked application to be available through the NYSERDA and Pace Energy Project websites. It is intended to step prospective project developers, owners, and planning/code officials through all applicable regulations governing smaller-scale (less than 10 MW) on-site generation projects. The focus of the guidebook is for non-major facilities installing clean CHP technologies (reciprocating engines, microturbines, fuel cells, combustion turbines), but some information is provided on major facilities.

The public outreach process for development of the Guidebook included three one-day long meetings held in large venues for diverse interest groups, and two smaller half-day meetings that were held with individuals who had particular expertise with building and public health/safety codes, air permitting regulations, and actual project development.

For all but small DG applications, the principal permitting hurdle is likely to be the air permit. For this reason, the guidebook has been set up to first determine which air permit

requirements will apply, and the other permitting and code requirements follow. It is not expected that a user would see all of these screens; only those that apply for their situation. The process flow chart shown in Figure 1 illustrates the typical procedure that a user would need to follow. The next section of this paper describes more detail on some of the relevant regulations and issues that are more fully described in the guidebook.

Figure 1. DG Siting, Permitting and Codes Process Flow



Codes, Siting And Permitting Issues Pertinent To CHP And Clean DG

Air Permitting

Our research has determined that the primary issues for siting CHP and clean DG projects are in the realm of the air permitting process. CHP and Clean DG projects in New York State face essentially two air permitting regimes. There is one set of rules for the Severe Ozone Non-Attainment area of New York City, Long Island, Westchester and Lower

Orange County. There is another set of rules that pertain to the Ozone Non-Attainment area that covers the remainder of New York State.

Minor Source Registration. Minor source registration is available to a site based upon the total potential to emit (PTE) from all points sources located at that site. In order to qualify for a registration, the PTE must be less than 50% of the major source threshold for regulated pollutants: nitrogen oxides, sulfur dioxide, carbon monoxide, and particulate matter.

In New York State there are presently three "levels" of air permitting for stationary generators defined in 6 NYCRR Part 201[2]. These are Minor Source Registrations, State Facilities Permits and Major Source (Title V) Permits.

Registration is the least stringent level of permitting available to a site. The Registration form is one page in length. Valid registrations, once obtained, generally last forever. They require no renewal absent a facility modification or a sufficient increase in emissions that warrant re-opening the permit. Registrations offer little to no operational flexibility. There are no "permit conditions" attached to the Registration that would provide some operational flexibility, as in the case of the State Facilities Permit.

State Facilities Permit. State Facilities Permits cover those sites where the potential to emit from all sources exceeds the cap-by-rule thresholds enumerated in the prior section, but can be maintained below the major source thresholds that require a Title V (Major Source) Air Permit. This would include facilities with a potential to emit that is less than the major source threshold, for example less than 25 TPY of NOX in the Severe Non-Attainment Areas of the State. It also includes a class of sites identified as "synthetic minors". These are sites that have a potential to emit that is in excess of one or more of the major source thresholds. However, the site will accept legally binding permit conditions, such as restrictions on the number of hours of operation, or on the fuel type. Based upon these binding *permit conditions*, the sites then fall below the major source thresholds and are able to avoid the requirements for obtaining a Major Source permit

Title V Facility (Major Source) Permit. Title V Facility Air Permits are required of any source whose air emissions exceed the major source thresholds. For CHP and Clean DG projects generally, the binding major source thresholds may be the following:

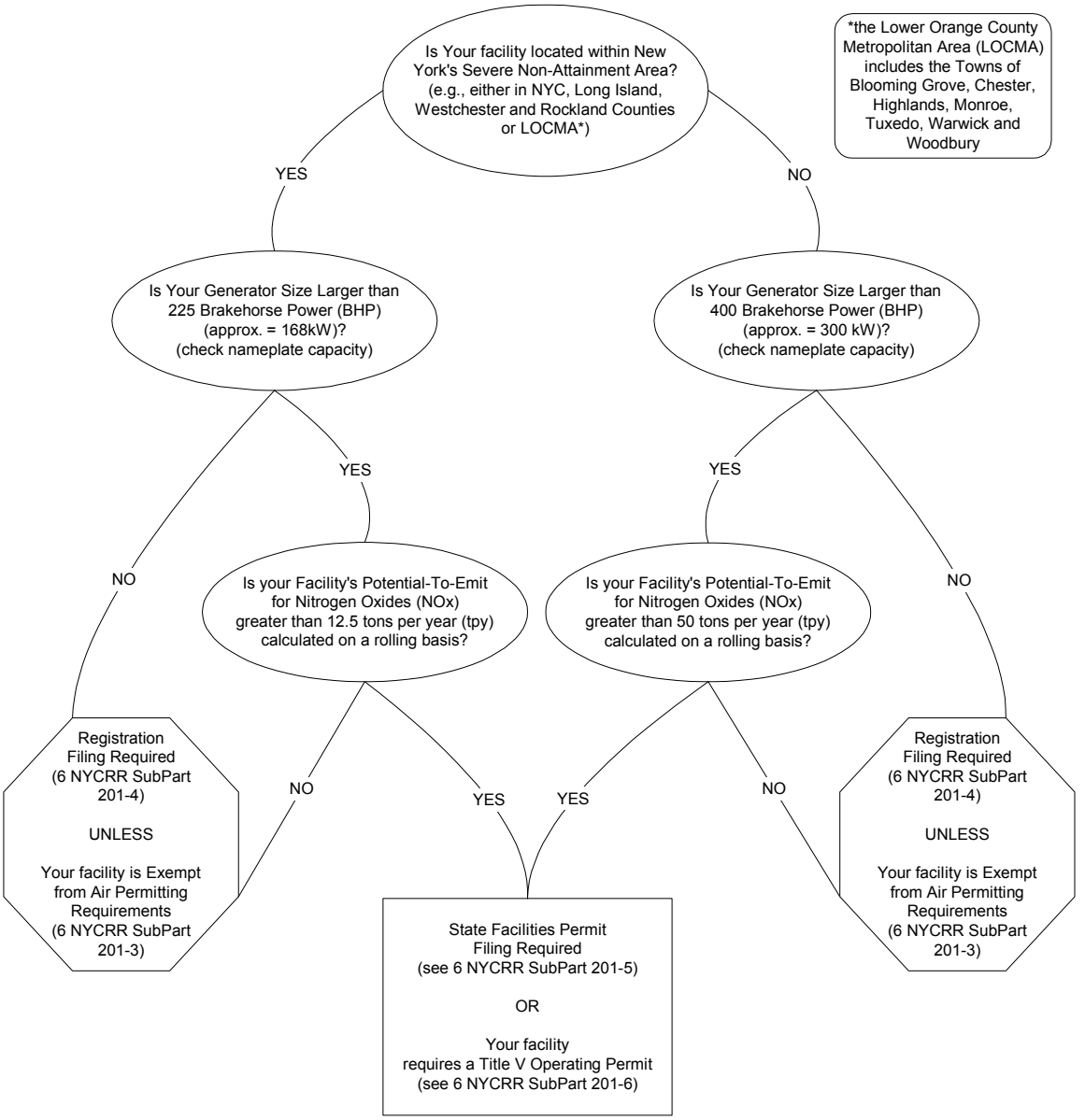
- 25 tons of NOX in the Severe Non-Attainment Area
- 100 tons of NOX elsewhere in the State

Recall that these levels consider emissions from all sources at the facility. The permitting category (exempt, registration, etc.,) is based on the <u>total</u> NOX emissions from the proposed site, including any existing boilers or other combustion equipment/emitters at the site. The Title V Facility Permit process is a lengthy one. It requires a public hearing and open comment process. Once acquired, Title V Facility Permits require annual reports related to facility compliance and extensive monitoring and recordkeeping in support of compliance.

[2] The Environmental Conservation Rules and Regulations are found in Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (*6 NYCRR)* Part 201is the section of this body of law that governs permits and registrations (6 NYCRR Part 201 – Permits and Registrations).

For most small to medium applications (those targeted through the Guidebook), Title V will not apply.

Figure 2. Overview of Small Generator Air Permitting



Building Codes and Permits

Siting of distributed CHP equipment involves approval by local, regional, and/or state agencies and acceptance by the affected communities. These agencies include the local fire departments, building departments, planning departments, and regional air quality districts. Depending on the level of concern and state of knowledge about distributed generation and CHP technologies and benefits, DG/CHP projects may be delayed or have their costs increased by local siting and permitting issues. Due to lack of familiarity with the

technologies, these projects may be faced with meeting conditions that exceed standards and requirements governing more conventional technologies that are quite similar in operational characteristics and risks. Prior efforts by NYSERDA have confirmed that uniform siting and permitting standards have not been developed for small CHP units by any State or local authorities. The advent of such standards would be expected to significantly expedite the penetration of CHP into the marketplace.

The siting issues exclusive of air permitting are those governed by building codes, electrical mechanical and fire codes, planning and zoning ordinances, noise and visual/aesthetics regulations. The applicable codes are essentially covered under one of two regulatory regimes within the State. The building codes (including building, electrical, fuel gas code, fire codes, electrical code, etc.,) are governed by a system of statewide codes for the 62 counties of New York State outside of New York City. Within the five boroughs of New York, these activities are governed by the codes of New York City.

Most of the concerns and issues involved in the DG/CHP siting process are land-use planning and public health / safety issues. Land use issues arise if there is a concern with zoning or proximity to sensitive receptors such as schools, hospitals, daycare centers and environmentally sensitive areas. Public Health/Safety concerns are expressed in the codes enforcement process. Examples of public health/safety concerns would include the following.

Fire departments must ensure that there are no fire and safety hazards. In New York City, all installations with gas pressures in excess of 15 psi are under the regulations of the Fire Department of the City of New York (FDNY). A Fire Department inspection is required for all such systems. For residential installations the threshold is greater than 2 psi.

Electrical Codes regulate the safe and secure operation of CHP projects. In New York City there are both *i. Filing* and *ii. Approval* processes that must be met, dependent upon project size. Any project above 480v must be filed with the NYC Bureau of Electrical Control (BEC). Projects 1000 kVa and greater must be approved by the BEC Advisory Board.

Inside a building structure fuel gas supply is governed by the Fuel Gas Code of New York State[3] which is based on the International Fuel Gas Code with some New York specific modifications. This code covers materials, construction, installation of fuel gas piping systems, components, fuel gas utilization equipment and related accessories.

For units that may be sited in neighborhood communities, other issues that arise include noise and visual/aesthetics concerns. Noise concerns have slowed down certain DG/CHP approvals in the past. We have been made aware that some "dump radiators" / heat rejection systems used in CHP systems can act like sound amplifiers and have been known to cause extra noise problems. Noise problems, whatever their source, are generally covered through local zoning or planning ordinances that vary by locality. In New York City, the Department of Environmental Protection (DEP) is the lead agency on noise regulation. Outside of New York City, the application of regulation can vary from community to community. There is however an extensive DEC Guidance Document on noise that is available to shape community standards.[4]

Building and construction inspectors' lack of familiarity with CHP/Clean DG units can result in requirements that exceed current standards and codes. This is hindered by the

[3] The Fuel Gas Code of New York is applicable to all areas of the State other than New York City.

[4] *Assessing and Mitigating Noise Impacts*, Division of Environmental Permits, October 2000. Source: www.dec.state.ny.us/website/decs/policy/noise/noise2000.pdf

lack of standards for small CHP equipment. Most CHP equipment operations are fairly straightforward, but some agencies request information that can delay installing the equipment, due to unfamiliarity with the technology. Because CHP equipment may be required to install air pollution control technology, hazardous materials (e.g., ammonia, sulfuric acid) may be involved. Additional approvals are needed to ensure onsite safety and proper handling and transport of hazardous materials, as well as ensuring that measures are taken to minimize and eliminate accidental releases of hazardous materials. The lack of knowledge by the local authorities sometimes results in construction 'over-design', which can increase the cost of installation.

Non-uniformity has been raised as a significant concern. Regulatory and compliance requirements differ from district to district. Certain localities and regions will have more stringent siting and permitting requirements, due to special local circumstances or local preferences. Some areas may require more information than others, processing fees may be more expensive and different impacts may be of greater concern in one area, while of lesser concern in another. Oftentimes, regulations do not change nearly as quickly as technology improves. Localities and regions may inadvertently and unduly restrict the adoption of new technologies in part due to the application of procedures and methods that are costly in terms of developer time and efforts. If these markets are to mature they will require more uniform application of regulatory oversight, while at the same time, guaranteeing that legitimate public health and safety concerns are met.

Conclusions and Lessons Learned

The experience of developing the New York State Guidebook has resulted in learning a great deal about the sometimes arcane and occasionally even contradictory regulations that govern DG system development. The applicable regulations are most complex in New York City, which due to its size and the population density, has a unique set of building and environmental codes and regulations. The City is currently considering moving toward adoption of national model building codes to help bring high construction costs under control.

The process of developing the guidebook forced many different stakeholders and diverse regulators to get together to understand how their various regulations impacted DG development and the interaction of guidelines across agencies. Particularly in New York City, where there is overlapping jurisdictional review, the process can be confusing and uncertain.

Successful project developers stressed the need for communication and cooperation. When dealing with local and regional regulators, one project developer maintained that the key was “communication, communication, communication”.

From the project development side there was a concern for greater uniformity, clarity, simplicity and certainty to be brought to the siting and permitting process. They would like to know precisely what the groundrules are, and to have a high degree of confidence that if they follow prescribed steps, that a project will be approved in a timely manner. For the developer time and risk are the critical variables.

The mandate of the regulators is to protect public health and safety and to safeguard the public’s interest in protecting air quality and such infringements on the quality of life as undue noise and visual impacts. Our experience informs us that the regulators are interested

in accommodating CHP and Clean DG project development, but at times the framework in which they operate may preclude that from happening as quickly or as painlessly as they and the client would like.

One clear lesson learned was that a review of the air permit process as it pertains to CHP and clean DG was warranted. In fact, a thoroughgoing review is now taking place at the State DEC. One objective that emerged was the importance of creating a "fast-tracking" process for demonstrably clean DG projects. One that requires a minimum amount of time and cost and yet gives regulators confidence that air quality standards are being upheld and improved.

The local codes and siting process is a much more difficult arena in which to impose uniformity, clarity and certainty. We learned that local codes officials in general were likely to be poorly informed about these new technologies and applications. Among our expert panel of advisors were key building codes officials from New York City, the Fire Department of New York, the Director of the Albany Chapter of the New York State Building Officials Conference (NYSBOC) and codes experts from the Department of State's Code Enforcement Unit.

One way to get the word out to codes officials is through a formal education and training campaign. The Albany Chapter President of NYSBOC, for example, has suggested participation on the agenda of one of the association's regularly scheduled meetings. Another source of information dissemination is the development of brochures targeted to the local codes community addressing these new applications and providing a set of "FAQ's" (frequently asked questions) that codes officials may have about their implementation. Another alternative is the development of pre-packaged guides to the siting and permitting of CHP and clean DG applications in particular target sectors. A model for this approach is the work of the Governor's Office of Regulatory Reform (GORR) and Empire State Development Corporation (ESDC) that have developed the concept of "shovel-ready" sites for economic development and have worked with consultants to create a blueprint to facilitate the siting of semiconductor facilities through their Semi-NY program.

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