



Planning Sustainable Neighborhoods

Anatomy of a Project—From District One to Microgrid

A Town+Gown Symposia Event

New York Public Library Branch @ 455 Fifth Avenue

June 18, 2013 (8:30 a.m. to 10:30 a.m.)

It Began with Action-Research to Address Issue of Light Waste. Shortly after academic year 2011-2012 ended, ExpoTENTIAL approached Town+Gown to partner on a research project in the fall with a fall with a graduate student-team from Cornell University's City and Regional Planning (CRP) program (the "Fall Project").¹ ExpoTENTIAL, a curated multi-dimensional collaborative platform, develops lab projects that mobilize members of the city's design community to investigate complex, pressing and sustainability-related challenges, such as climate change and energy efficiency, using the physical city as a context for design and using design as a strategy.² Design has been increasingly playing a role in shaping urban spaces, and designers see how design can play a role as a mediator between the citizen and government.³

ExpoTENTIAL started to address the urban issue of light waste—think, the lights on and no one home, the

¹ Vidhee Garg, Jacob McNally, Rebecca Parelman, Jiang Ren and Steven Wang, *Rethinking the Grid*, Fall 2012.

² ExpoTENTIAL lab projects leverage the skills of designers to work outside their standard client-driven role on urban issues, with a team curator, to address and translate particular issues into engaging, in-situ public works, creating urban interventions that combine "hardware" and "software," viral and coordinated communications, and educational and entertainment. See <http://expotential.info/>.

³ See http://www.nyc.gov/html/ddc/downloads/pdf/town_and_gown/Symposia/DesignBeginEnd.pdf and http://www.nyc.gov/html/ddc/downloads/pdf/town_and_gown/Symposia/05_21_13_precis_stripe.pdf

iconic city skyline at night—as the subject of one of its lab projects. In order to identify how design might mediate between citizen and government on this particular issue, ExpoTENTIAL, in collaboration with its designer and curator partners, hoped research would provide the contextual basis to develop meaningful action strategies to engage the citizen in various light-saving actions and awareness campaigns. The Fall Project would use the City's first electrified energy grid, District One, as both the study site and symbolic territory. Serviced by the Pearl Street Station, built in 1882, District One was the first modern electric utility covering "a rectangular .65 square-kilometer area bordered by Wall Street to the south."⁴

The District One Lab Project—Identifying the Problems of Scale. To help ExpoTENTIAL develop its light waste lab project, it was first necessary to understand the production and distribution of electricity. The CRP students moved from a visualization of energy related data to researching the nature of the physical infrastructure that is at once the local, regional and national electric power grid. The focus on the physical infrastructure opened up the field of analysis, moving it far beyond the point at which a person flips the light switch on the wall to the complex systemic and regulatory processes that control it.

⁴ Ania Monaco, "Edison's Pearl Street Station Recognized With Milestone," *The Institute*, July 27, 2011, see <http://theinstitute.ieee.org/technology-focus/technology-history/edisons-pearl-street-station-recognized-with-milestone810>

The CRP students' research path explored issues raised at the April 3, 2012 Symposium event, *How to Create Sustainable Neighborhoods?* The environmental sustainability agenda specifically mobilizes local interest in action for change as a strategy and as a methodology—*think globally, act locally*. But complex systems implicated in the sustainability agenda, such as the energy system, create real spatial, legal, financial and political barriers that frustrate local initiatives. The City's efforts have primarily engaged those local laws that regulate public and private buildings.⁵ While the City's efforts in these areas are on a city-wide scale, the students suggested that even large-scale local initiatives focusing on building energy use, waste and conservation may be insufficient due to the nature of the system of which the local jurisdiction is only a part. Further, the prospective nature of intervention *via* building codes may render the costs to individual buildings, and even in the aggregate, higher than the respective benefits.

Hewing to District One as the study area and conceptual symbol for the project, the students identified options used elsewhere⁶ that aim to alter energy use by changing incentives in the grid system that supplies energy to buildings within a local jurisdiction. There is significant waste in the broader system, which the last deregulation paradigm of

⁵ The subject matter for legislation by local jurisdictions is necessarily limited by the jurisdictional boundaries. In New York, judicial interpretations of the State's home rule provision significantly limit local jurisdictions ability to legislate. Local building and zoning codes are two areas generally conceded to be of local concern, and the City takes full advantage of regulating in these areas. See Lynn Baker and Daniel Rodriguez, "Constitutional Home Rule and Judicial Scrutiny", *Denver Law Review*, Volume 86:4 (2009), pp. 1342-1424.

⁶ See Connecticut General Statutes, Title 32, Chapter 585; see also Chet Warner, "Connecticut Legislature Passes Energy Improvement Legislation: Bill to Allow Implementation of Energy Improvement Districts in Connecticut Cities" *U.S. Mayor Newspaper* (The United States Conference of Mayors), June 18, 2007. http://www.usmayors.org/usmayornewspaper/documents/06_18_07/page17_Connecticut.asp

decoupling energy generation from energy distribution did not fully address at the system-wide level. Encouraging the creation of district-wide grids—or microgrids—that permit greater overall reduction in carbon emissions than do regulations aimed at the building scale, however, requires government action at the higher state level in view of the regulatory environment for privately-owned electric and gas utilities and the inability of local governments to act locally in areas of broad statewide interest or when there is extra-territorial impact.⁷

The CRP students concluded that reducing carbon emissions locally not only required continuing the local efforts aimed at the building level but also required focusing on making changes at the grid level within the jurisdiction. Instead of a single approach, local jurisdictions need to intervene at different scales and turn their focus to the larger scale infrastructure within their boundaries. These conclusions echoed some of the comments at the April 2012 event—namely, that attempts at local action related to energy will need to acknowledge the relation to the larger macro-scale infrastructure and overcome real impediments to change at the macro-infrastructure system scale.

The Exit Project—Identifying Ways to Move beyond Limits on Local Action. Jacob McNally, one of the CRP students from the Fall Project, continued to pursue the research path in an exit project research paper entitled *Unleashing the Power of the Microgrid: Designing the Modern Electricity Regulatory Framework*. The effects of Super Storm Sandy, visible in real time during both the Fall Project and the exit project, underscored the challenges facing the existing energy grid and its need for modernization to increase resiliency as well as contribute to the reduction of carbon emissions. Technological advances

⁷ See Town+Gown analysis of utilities operating under the roadway at http://www.nyc.gov/html/ddc/downloads/pdf/town_and_gown/Symposia/Roadway.2.pdf; see also Baker and Daniel, *op. cit.*, pp. 1342-43, especially footnote 37.

foreshadow the ability to generate greater reductions in carbon emissions at a larger scale with the incremental costs shared over a larger area and among more stakeholders than is possible for jurisdictions acting alone using the limited legal tools available to them. Changes in public opinion that bring pressure to achieve what appears to be technologically possible, however, confront political, economic and legal realities that are slower to change.

The regulatory decoupling of energy generation from transmission coupled with engineering and technology innovations improving aspects of energy generation at the local level are increasing the incidence of customer-sited energy production.⁸ The distributed generation (“DG”) model, the opposite of the centralized model that has characterized the development of energy infrastructure in the United States, consists of an electric generation system powered by smaller sources off of the centralized power distribution grid, often sited on the building owner’s property.⁹ DG systems connect to the larger distribution grid from the “customer side of the meter”, and the sources to power them can run from diesel fuel to natural gas to other sources of energy of either a renewable nature or with decreased carbon emissions.¹⁰ Engineering and technology advances permit some energy sources, like natural gas, to fuel combined heat and power (“CHP”) plants.¹¹

Microgrids are “small-scale energy systems that integrate multiple distributed energy resources with a group of interconnected customers and can operate in parallel or isolation from the grid.”¹² They “connect multiple DG sources at a community or district scale” and “support the integration of electricity with other energy systems” with the potential to produce greater economies of scale and benefits than are possible at the building DG scale and provide an intermediate

scale element to help the centralized providers reduce waste and inefficiencies at the centralized level.¹³ This intermediate scale also has the potential to facilitate the centralized providers’ upgrade of grid infrastructure to include “smart grid” technology that “uses information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion.”¹⁴

Microgrids will require either a physical connection to the larger grid’s distribution infrastructure network “backbone”,¹⁵ which is known as a physical microgrid, or use the existing backbone “to integrate and manage a group of customers,” which is known as a virtual microgrid.¹⁶ To begin to develop the mid-range space of the microgrid, whether physical or virtual, as a policy solution to environmental sustainability and/or resiliency concerns, it will be necessary to identify and address the complex issues of public utility regulation in New York State.¹⁷

Discussion about Next Steps. Engineering and technology related to the generation, transmission and delivery of energy continually change and improve, increasing the potential to reduce waste and carbon emissions and increase system efficiencies. The challenge in the present regulatory paradigm that created and supports the centralized system is to develop an alternative paradigm that permits an optimum combination of centralized and decentralized power production to speed

⁸ McNally, p. 2.

⁹ McNally, p. 4

¹⁰ McNally, p. 8

¹¹ *Idem*; see also pp. 9-11.

¹² McNally, p. 12

¹³ McNally, pp. 8-9. Technically, micro grids “connect electric loads.” McNally, p. 9.

¹⁴ From Wikipedia, http://en.wikipedia.org/wiki/Smart_grid; see also, McNally, p. 11.

¹⁵ McNally, p. 12; see also the federal Telecommunications Act of 1996 template as a metaphor for microgrids in the context of the as-built distribution grid infrastructure.

¹⁶ McNally, p. 13; see also, p. 14 for other classifications.

¹⁷ McNally, pp. 26-33, 38-44; see footnote 7; see also Initiative 21 under “Utilities” in the City’s report entitled *A Stronger, More Resilient New York* at: http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch_6_Utilities_FINAL_singles.pdf.

modernization of the grid infrastructure, maximize system flexibility and resiliency (in part due to redundancy), increase the use of renewable energy sources across the system from multiple points, and reduce waste from the centralized transmission system and at customer sites, thus maximizing reductions in carbon emissions system-wide over time.¹⁸

Politically, however, the microgrid represents a technologically-possible conceptual midpoint between the locally-possible regulation of individual buildings via building codes and zoning regulations and the larger energy systems regulated at different scales by the state and the federal governments. This new midpoint focus made possible by technology will also create rifts in the conventional regulatory paradigm. The microgrid also represents the physical mid distance between geographic groupings of individual buildings and owners/users and the larger centralized system that spans beyond local jurisdictional boundaries. These research projects identified the physical and legal impediments to local action posed by a large infrastructure system, with multiple stakeholders outside the jurisdiction and governed by a complex regulatory apparatus not particularly responsive to the position of any one jurisdiction as a legal entity or its residents, individually or collectively.

People in any one place in the United States are citizens with respect to several levels of government—their city or town, their county and the nation.¹⁹ Citizens need to understand, especially when it comes to the state-local divide, that pressing the locality on issues that are physically larger than the jurisdiction and with respect to which the local government is limited in its ability to act, may have unintended negative consequences that could be avoided by focusing efforts at the higher level of government. But how is it possible to move the “act locally, think globally” strategy up the scale to the regulated utility level?

¹⁸ McNally, pp. 6-7; *see also*, pp. 15-23.

¹⁹ New York City is coterminous with five counties.

- Design

How can the design fields help to tell the story of the electric grid—what it is, how it works, who controls its future—as a tool for understanding the grid and for understanding what it means to “act locally” in this context?

- Planning

State law considers land use to be almost a purely local activity—what kinds of local planning actions can help to reduce carbon emissions?

To the extent the physical scale of systems related to sustainability make local solutions less than optimal, what would be appropriate role for planning on a regional or statewide level?

- Economics/Law

What changes to the statewide utility regulatory paradigm would be needed to realize the potential system-wide benefits achievable by leveraging the mid-point space of the microgrid?

What changes to the law would be necessary to support such a rethinking of the regulatory paradigm?

- Technology

To what extent could purely technological advances mitigate some of the projected political/economic/legal shifts?